

# CD74HC137, CD74HCT137, CD54HC237, CD74HC237, CD74HCT237

## High-Speed CMOS Logic, 3- to 8-Line Decoder/Demultiplexer with Address Latches

### Features

- **Select One of Eight Data Outputs**
  - Active Low for CD74HC137 and CD74HCT137
  - Active High for 'HC237 and CD74HCT237
- **I/O Port or Memory Selector**
- **Two Enable Inputs to Simplify Cascading**
- **Typical Propagation Delay of 13ns at  $V_{CC} = 5V$ , 15pF,  $T_A = 25^\circ C$  (CD74HC237)**
- **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 CD74HC137, CD74HCT137, 'HC237, and CD74HCT237 are high speed silicon gate CMOS decoders well suited to memory address decoding or data routing applications. Both circuits feature low power consumption usually associated with CMOS circuitry, yet have speeds comparable to low power Schottky TTL logic.

Both circuits have three binary select inputs ( $A_0$ ,  $A_1$  and  $A_2$ ) that can be latched by an active High Latch Enable (LE) signal to isolate the outputs from select-input changes. A "Low" LE makes the output transparent to the input and the circuit functions as a one-of-eight decoder. Two Output Enable inputs ( $\overline{OE}_1$  and  $OE_0$ ) are provided to simplify cascading and to facilitate demultiplexing. The demultiplexing function is accomplished by using the  $A_0$ ,  $A_1$ ,  $A_2$  inputs to select the desired output and using one of the other Output Enable inputs as the data input while holding the other Output Enable input in its active state. In the CD74HC137 and CD74HCT137 the selected output is a "Low"; in the 'HC237 and CD74HCT237 the selected output is a "High".

### Ordering Information

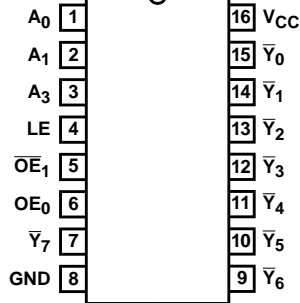
| PART NUMBER   | TEMP. RANGE<br>( $^\circ C$ ) | PACKAGE      |
|---------------|-------------------------------|--------------|
| CD54HC237F3A  | -55 to 125                    | 16 Ld CERDIP |
| CD74HC137E    | -55 to 125                    | 16 Ld PDIP   |
| CD74HC137PW   | -55 to 125                    | 16 Ld TSSOP  |
| CD74HC137PWR  | -55 to 125                    | 16 Ld TSSOP  |
| CD74HC137PWT  | -55 to 125                    | 16 Ld TSSOP  |
| CD74HC237E    | -55 to 125                    | 16 Ld PDIP   |
| CD74HC237M    | -55 to 125                    | 16 Ld SOIC   |
| CD74HC237MT   | -55 to 125                    | 16 Ld SOIC   |
| CD74HC237M96  | -55 to 125                    | 16 Ld SOIC   |
| CD74HC237NSR  | -55 to 125                    | 16 Ld SOP    |
| CD74HC237PW   | -55 to 125                    | 16 Ld TSSOP  |
| CD74HC237PWR  | -55 to 125                    | 16 Ld TSSOP  |
| CD74HC237PWT  | -55 to 125                    | 16 Ld TSSOP  |
| CD74HCT137E   | -55 to 125                    | 16 Ld PDIP   |
| CD74HCT137MT  | -55 to 125                    | 16 Ld SOIC   |
| CD74HCT137M96 | -55 to 125                    | 16 Ld SOIC   |
| CD74HCT237E   | -55 to 125                    | 16 Ld PDIP   |

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

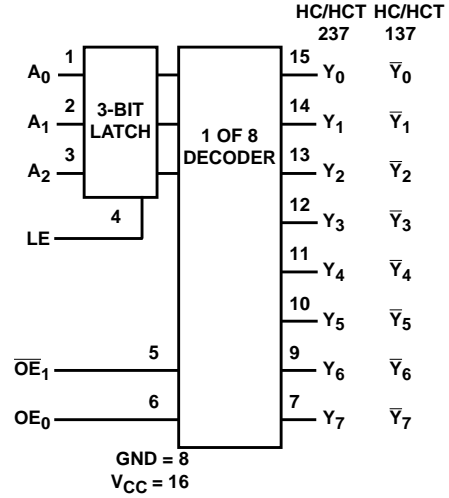
# CD74HC137, CD74HCT137, CD54HC237, CD74HC237, CD74HCT237

## Pinout

CD54HC237 (CERDIP)  
 CD74HC137 (PDIP, TSSOP)  
 CD74HCT137 (PDIP, SOIC)  
 CD74HC237 (PDIP, SOIC, SOP, TSSOP)  
 CD74HCT237 (PDIP)  
 TOP VIEW



## Functional Diagram



'HC137, 'HCT137 TRUTH TABLE

| INPUTS |                 |                 |                |                |                | OUTPUTS  |                |                |                |                |                |                |                |
|--------|-----------------|-----------------|----------------|----------------|----------------|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| LE     | OE <sub>0</sub> | OE <sub>1</sub> | A <sub>2</sub> | A <sub>1</sub> | A <sub>0</sub> | Y <sub>0</sub>   | Y <sub>1</sub> | Y <sub>2</sub> | Y <sub>3</sub> | Y <sub>4</sub> | Y <sub>5</sub> | Y <sub>6</sub> | Y <sub>7</sub> |
| X      | X               | H               | X              | X              | X              | H  | H              | H              | H              | H              | H              | H              | H              |
| X      | L               | X               | X              | X              | X              | H  | H              | H              | H              | H              | H              | H              | H              |
| L      | H               | L               | L              | L              | L              | L  | H              | H              | H              | H              | H              | H              | H              |
| L      | H               | L               | L              | L              | H              | H  | L              | H              | H              | H              | H              | H              | H              |
| L      | H               | L               | L              | H              | L              | H  | H              | L              | H              | H              | H              | H              | H              |
| L      | H               | L               | L              | H              | H              | H  | H              | H              | L              | H              | H              | H              | H              |
| L      | H               | L               | H              | L              | L              | H  | H              | H              | H              | L              | H              | H              | H              |
| L      | H               | L               | H              | L              | H              | H  | H              | H              | H              | H              | L              | H              | H              |
| L      | H               | L               | H              | H              | L              | H  | H              | H              | H              | H              | H              | L              | H              |
| L      | H               | L               | H              | H              | H              | H  | H              | H              | H              | H              | H              | H              | L              |
| H      | H               | L               | X              | X              | X              | Depends upon the address previously applied while LE was at a logic low. |                |                |                |                |                |                |                |

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

'HC237, 'HCT237 TRUTH TABLE

| INPUTS |                 |                 |                |                |                | OUTPUTS  |                |                |                |                |                |                |                |
|--------|-----------------|-----------------|----------------|----------------|----------------|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| LE     | OE <sub>0</sub> | OE <sub>1</sub> | A <sub>2</sub> | A <sub>1</sub> | A <sub>0</sub> | Y <sub>0</sub>   | Y <sub>1</sub> | Y <sub>2</sub> | Y <sub>3</sub> | Y <sub>4</sub> | Y <sub>5</sub> | Y <sub>6</sub> | Y <sub>7</sub> |
| X      | X               | H               | X              | X              | X              | L  | L              | L              | L              | L              | L              | L              | L              |
| X      | L               | X               | X              | X              | X              | L  | L              | L              | L              | L              | L              | L              | L              |
| L      | H               | L               | L              | L              | L              | H  | L              | L              | L              | L              | L              | L              | L              |
| L      | H               | L               | L              | L              | H              | L  | H              | L              | L              | L              | L              | L              | L              |
| L      | H               | L               | L              | H              | L              | L  | L              | L              | H              | L              | L              | L              | L              |
| L      | H               | L               | L              | H              | H              | L  | L              | L              | L              | L              | L              | L              | L              |
| L      | H               | L               | H              | L              | L              | L  | L              | L              | L              | H              | L              | L              | L              |
| L      | H               | L               | H              | L              | H              | L  | L              | L              | L              | L              | H              | L              | L              |
| L      | H               | L               | H              | H              | L              | L  | L              | L              | L              | L              | L              | H              | L              |
| L      | H               | L               | H              | H              | H              | L  | L              | L              | L              | L              | L              | L              | H              |
| H      | H               | L               | X              | X              | X              | Depends upon the address previously applied while LE was at a logic low. |                |                |                |                |                |                |                |

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

**Functional Block Diagram**



# CD74HC137, CD74HCT137, CD54HC237, CD74HC237, CD74HCT237

## Absolute Maximum Ratings

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

## Thermal Information

|  |                |
|--|----------------|
| Package Thermal Impedance, $\theta_{JA}$ (see Note 1): |                |
| E (PDIP) Package .....                                 | 67°C/W         |
| M (SOIC) Package .....                                 | 73°C/W         |
| NS (SOP) Package .....                                 | 64°C/W         |
| PW (TSSOP) Package .....                               | 108°C/W        |
| 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)                                |                |

## 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   |
| 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      |            | $V_{CC}$ (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     |         |
| <b>HC TYPES</b>                         |          |                      |            |              |      |     |           |               |         |                |         |         |
| High Level Input Voltage                | $V_{IH}$ | -                    | -          | 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                 | $V_{IL}$ | -                    | -          | 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 | $V_{OH}$ | $V_{IH}$ or $V_{IL}$ | -0.02      | 2            | 1.9  | -   | -         | 1.9           | -       | 1.9            | -       | V       |
|   |          |                      | -0.02      | 4.5          | 4.4  | -   | -         | 4.4           | -       | 4.4            | -       | V       |
|   |          |                      | -0.02      | 6            | 5.9  | -   | -         | 5.9           | -       | 5.9            | -       | V       |
| High Level Output Voltage<br>TTL Loads  | $V_{OH}$ | $V_{IH}$ or $V_{IL}$ | -          | -            | -    | -   | -         | -             | -       | -              | -       | V       |
|   |          |                      | -4         | 4.5          | 3.98 | -   | -         | 3.84          | -       | 3.7            | -       | V       |
|   |          |                      | -5.2       | 6            | 5.48 | -   | -         | 5.34          | -       | 5.2            | -       | V       |
| Low Level Output Voltage<br>CMOS Loads  | $V_{OL}$ | $V_{IH}$ or $V_{IL}$ | 0.02       | 2            | -    | -   | 0.1       | -             | 0.1     | -              | 0.1     | V       |
|   |          |                      | 0.02       | 4.5          | -    | -   | 0.1       | -             | 0.1     | -              | 0.1     | V       |
|   |          |                      | 0.02       | 6            | -    | -   | 0.1       | -             | 0.1     | -              | 0.1     | V       |
| Low Level Output Voltage<br>TTL Loads   | $V_{OL}$ | $V_{IH}$ or $V_{IL}$ | -          | -            | -    | -   | -         | -             | -       | -              | -       | V       |
|   |          |                      | 4          | 4.5          | -    | -   | 0.26      | -             | 0.33    | -              | 0.4     | V       |
|   |          |                      | 5.2        | 6            | -    | -   | 0.26      | -             | 0.33    | -              | 0.4     | V       |
| Input Leakage Current                   | $I_I$    | $V_{CC}$ or GND      | -          | 6            | -    | -   | $\pm 0.1$ | -             | $\pm 1$ | -              | $\pm 1$ | $\mu A$ |

**CD74HC137, CD74HCT137, CD54HC237, CD74HC237, CD74HCT237**

**DC Electrical Specifications (Continued)**

| PARAMETER  | SYMBOL                    | TEST CONDITIONS                    |                     | V <sub>CC</sub> (V) | 25°C |     |      | -40°C TO 85°C |      | -55°C TO 125°C |     | UNITS |
|--|---------------------------|------------------------------------|---------------------|---------------------|------|-----|------|---------------|------|----------------|-----|-------|
|  |                           | V <sub>I</sub> (V)                 | I <sub>O</sub> (mA) |                     | MIN  | TYP | MAX  | MIN           | MAX  | MIN            | MAX |       |
| Quiescent Device Current                                       | I <sub>CC</sub>           | V <sub>CC</sub> or GND             | 0                   | 6                   | -    | -   | 8    | -             | 80   | -              | 160 | μA    |
| <b>HCT TYPES</b>   |                           |                                    |                     |                     |      |     |      |               |      |                |     |       |
| High Level Input Voltage                                       | V <sub>IH</sub>           | -                                  | -                   | 4.5 to 5.5          | 2    | -   | -    | 2             | -    | 2              | -   | V     |
| Low Level Input Voltage  | V <sub>IL</sub>           | -                                  | -                   | 4.5 to 5.5          | -    | -   | 0.8  | -             | 0.8  | -              | 0.8 | V     |
| High Level Output Voltage<br>CMOS Loads                        | V <sub>OH</sub>           | V <sub>IH</sub> or V <sub>IL</sub> | -0.02               | 4.5                 | 4.4  | -   | -    | 4.4           | -    | 4.4            | -   | V     |
| High Level Output Voltage<br>TTL Loads                         |                           |                                    | -4                  | 4.5                 | 3.98 | -   | -    | 3.84          | -    | 3.7            | -   | V     |
| Low Level Output Voltage<br>CMOS Loads                         | V <sub>OL</sub>           | V <sub>IH</sub> or V <sub>IL</sub> | 0.02                | 4.5                 | -    | -   | 0.1  | -             | 0.1  | -              | 0.1 | V     |
| Low Level Output Voltage<br>TTL Loads                          |                           |                                    | 4                   | 4.5                 | -    | -   | 0.26 | -             | 0.33 | -              | 0.4 | V     |
| Input Leakage Current  | I <sub>I</sub>            | V <sub>CC</sub> and GND            | 0                   | 5.5                 | -    | -   | ±0.1 | -             | ±1   | -              | ±1  | μA    |
| Quiescent Device Current                                       | I <sub>CC</sub>           | V <sub>CC</sub> or GND             | 0                   | 5.5                 | -    | -   | 8    | -             | 80   | -              | 160 | μA    |
| Additional Quiescent Device Current Per Input Pin: 1 Unit Load | ΔI <sub>CC</sub> (Note 2) | V <sub>CC</sub> -2.1               | -                   | 4.5 to 5.5          | -    | 100 | 360  | -             | 450  | -              | 490 | μA    |

NOTE:

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

**HCT Input Loading Table**

| INPUT | UNIT LOADS |
|-------|------------|
| All   | 1.5        |

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

**Prerequisite For Switching Specifications**

| PARAMETER                       | SYMBOL          | 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 |       |
| <b>HC TYPES</b>                 |                 |                     |      |     |     |               |     |                |     |       |
| A <sub>n</sub> to LE Setup Time | t <sub>SU</sub> | 2                   | 50   | -   | -   | 65            | -   | 75             | -   | ns    |
|                                 |                 | 4.5                 | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
|                                 |                 | 6                   | 9    | -   | -   | 11            | -   | 13             | -   | ns    |
| A <sub>n</sub> to LE Hold Time  | t <sub>H</sub>  | 2                   | 30   | -   | -   | 40            | -   | 45             | -   | ns    |
|                                 |                 | 4.5                 | 6    | -   | -   | 8             | -   | 9              | -   | ns    |
|                                 |                 | 6                   | 5    | -   | -   | 7             | -   | 8              | -   | ns    |

**CD74HC137, CD74HCT137, CD54HC237, CD74HC237, CD74HCT237**

**Prerequisite For Switching Specifications (Continued)**

| PARAMETER           | SYMBOL          | 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 |       |
| LE Pulse Width      | t <sub>W</sub>  | 2                   | 50             | -   | -   | 65            | -   | 75             | -   | ns    |
|                     |                 | 4.5                 | 10             | -   | -   | 13            | -   | 15             | -   | ns    |
|                     |                 | 6                   | 9              | -   | -   | 1             | -   | 13             | -   | ns    |
| <b>HCT TYPES</b>    |                 |                     |                |     |     |               |     |                |     |       |
| An to LE Setup Time | t <sub>SU</sub> | 4.5                 | 10             | -   | -   | 13            | -   | 15             | -   | ns    |
| An to LE Hold Time  | t <sub>H</sub>  | 4.5                 | 7              | -   | -   | 9             | -   | 11             | -   | ns    |
|                     |                 | CD74HCT237          | t <sub>H</sub> | 4.5 | 5   | -             | -   | 5              | -   | 5     |
| LE Pulse Width      | t <sub>W</sub>  | 4.5                 | 10             | -   | -   | 13            | -   | 15             | -   | ns    |

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

| 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 |       |
| <b>HC TYPES</b>   |                                     |                       |                     |                 |                       |     |               |     |                |     |       |
| Propagation Delay<br>CD74HC137, CD74HCT137<br>An to any $\bar{Y}$ | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -               | -                     | 180 | -             | 225 | -              | 270 | ns    |
|   |                                     |                       | 4.5                 | -               | -                     | 36  | -             | 45  | -              | 54  | ns    |
|   |                                     |                       | 6                   | -               | -                     | 31  | -             | 38  | -              | 46  | ns    |
| Propagation Delay<br>'HC237, CD74HCT237<br>An to any Y            | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -               | -                     | 160 | -             | 200 | -              | 240 | ns    |
|   |                                     |                       | 4.5                 | -               | -                     | 32  | -             | 40  | -              | 48  | ns    |
|   |                                     |                       | 6                   | -               | -                     | 27  | -             | 34  | -              | 41  | ns    |
| Address to Output<br>CD74HC137                                    | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 15pF | 5                   | 5               | 15                    | -   | -             | -   | -              | ns  |       |
| 'HC237  | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 15pF | 5                   | -               | 13                    | -   | -             | -   | -              | ns  |       |
| OE <sub>0</sub> to any $\bar{Y}$ or Y                             | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -               | -                     | 145 | -             | 180 | -              | 220 | ns    |
|   |                                     |                       | 4.5                 | -               | -                     | 29  | -             | 36  | -              | 44  | ns    |
|   |                                     |                       | 6                   | -               | -                     | 25  | -             | 31  | -              | 38  | ns    |
| OE <sub>1</sub> to any $\bar{Y}$ or Y                             | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 2                   | -               | -                     | 145 | -             | 180 | -              | 220 | ns    |
|   |                                     |                       | 4.5                 | -               | -                     | 29  | -             | 36  | -              | 44  | ns    |
|   |                                     |                       | 6                   | -               | -                     | 25  | -             | 31  | -              | 38  | ns    |
| LE to any $\bar{Y}$ or Y  | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 2                   | -               | -                     | 190 | -             | 240 | -              | 285 | ns    |
|   |                                     |                       | 4.5                 | -               | -                     | 38  | -             | 48  | -              | 57  | ns    |
|   |                                     |                       | 6                   | -               | -                     | 32  | -             | 41  | -              | 48  | ns    |
| Power Dissipation<br>Capacitance, (Notes 3, 4)<br>CD74HC137       | C <sub>PD</sub>                     | C <sub>L</sub> = 15pF | 5                   | -               | 19                    | -   | -             | -   | -              | -   | pF    |
|   |                                     |                       | 'HC237              | C <sub>PD</sub> | C <sub>L</sub> = 15pF | 5   | -             | 23  | -              | -   | -     |
| Output Transition Time  | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 2                   | -               | -                     | 75  | -             | 95  | -              | 110 | ns    |
|   |                                     |                       | 4.5                 | -               | -                     | 15  | -             | 19  | -              | 22  | ns    |
|   |                                     |                       | 6                   | -               | -                     | 13  | -             | 16  | -              | 19  | ns    |
| Input Capacitance   | C <sub>I</sub>                      | -                     | -                   | -               | -                     | -   | -             | -   | -              | 10  | pF    |

# CD74HC137, CD74HCT137, CD54HC237, CD74HC237, CD74HCT237

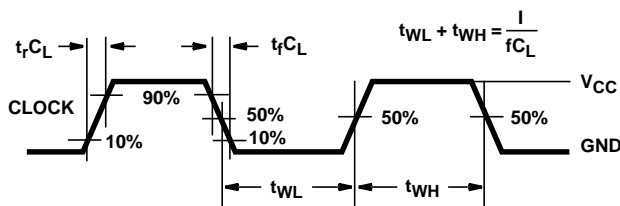
## Switching Specifications Input $t_r, t_f = 6\text{ns}$ (Continued)

| PARAMETER  | SYMBOL             | TEST CONDITIONS     | $V_{CC}$ (V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|--|--------------------|---------------------|--------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|  |                    |                     |              | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| <b>HCT TYPES</b>   |                    |                     |              |      |     |     |               |     |                |     |       |
| Propagation Delay<br>An to any $\bar{Y}$ or Y<br>Address to Output | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 38  | -             | 48  | -              | 57  | ns    |
|  | $t_{PLH}, t_{PHL}$ | $C_L = 15\text{pF}$ | 5            | -    | 16  | -   | -             | -   | -              | -   | ns    |
| $OE_0$ to any Y (HC137)  | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 35  | -             | 44  | -              | 53  | ns    |
| $OE_0$ to any $\bar{Y}$ (HC237)                                    | $t_{PLH}, t_{PHL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 33  | -             | 41  | -              | 60  | ns    |
| $\overline{OE}_1$ to any $\bar{Y}$ (HC137)                         | $t_{TLH}, t_{THL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 37  | -             | 46  | -              | 56  | ns    |
| $\overline{OE}_1$ to any $\bar{Y}$ (HC237)                         | $t_{TLH}, t_{THL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 35  | -             | 44  | -              | 53  | ns    |
| LE to any Y (HC137)  | $t_{TLH}, t_{THL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 44  | -             | 55  | -              | 66  | ns    |
| LE to any $\bar{Y}$ (HC237)  | $t_{TLH}, t_{THL}$ | $C_L = 50\text{pF}$ | 4.5          | -    | -   | 42  | -             | 53  | -              | 63  | ns    |
| Power Dissipation<br>Capacitance, (Notes 3, 4)                     |                    |                     |              |      |     |     |               |     |                |     |       |
| CD74HC137  | $C_{PD}$           | $C_L = 15\text{pF}$ | 5            | -    | 19  | -   | -             | -   | -              | -   | pF    |
| 'HC237   | $C_{PD}$           | $C_L = 15\text{pF}$ | 5            | -    | 23  | -   | -             | -   | -              | -   | pF    |
| Output Transition Time   | $t_{TLH}, t_{THL}$ | $C_L = 50\text{pF}$ | 4.5          |      |     | 15  |               | 19  |                | 22  | ns    |
| Input Capacitance  | $C_i$              | -                   | -            | -    | -   | 10  | -             | 10  | -              | 10  | pF    |

**NOTES:**

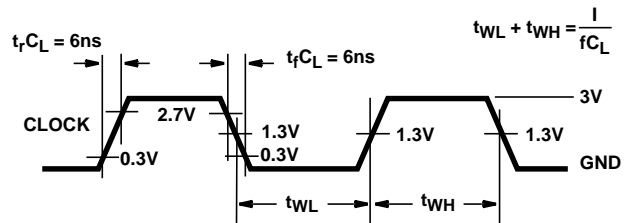
- $C_{PD}$  is used to determine the dynamic power consumption, per gate.
- $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where:  $f_i$  = Input Frequency,  $C_L$  = Output Load Capacitance,  $V_{CC}$  = Supply Voltage.

## Test Circuits and Waveforms



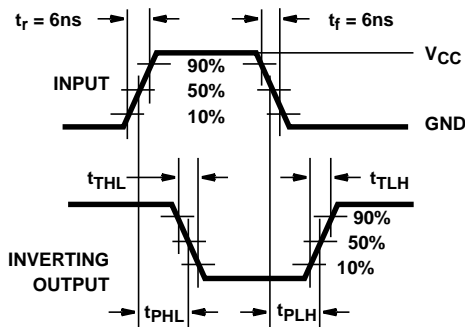
NOTE: Outputs should be switching from 10%  $V_{CC}$  to 90%  $V_{CC}$  in accordance with device truth table. For  $f_{MAX}$ , input duty cycle = 50%.

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

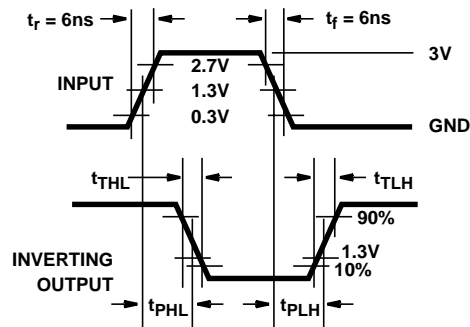


NOTE: Outputs should be switching from 10%  $V_{CC}$  to 90%  $V_{CC}$  in accordance with device truth table. For  $f_{MAX}$ , input duty cycle = 50%.

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



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



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

Test Circuits and Waveforms (Continued)

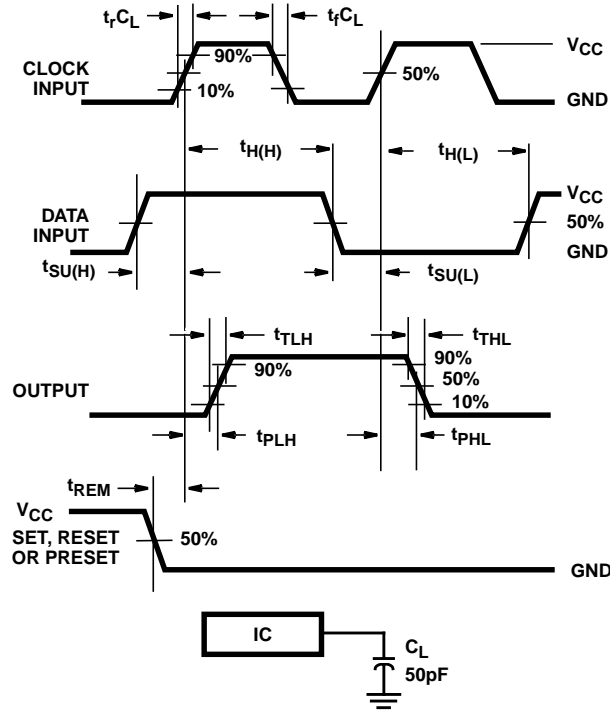


FIGURE 5. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

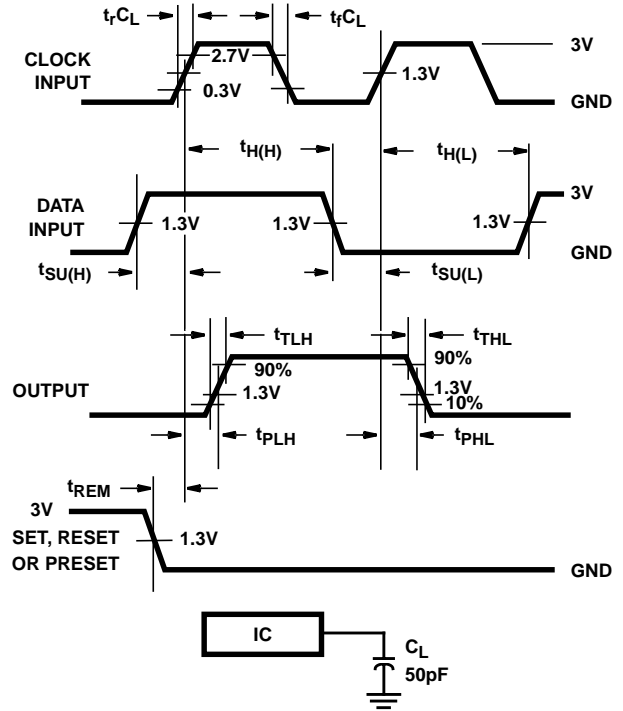


FIGURE 6. HCT SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS



**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-8860601EA   | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| CD54HC237F       | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| CD54HC237F3A     | ACTIVE                | CDIP         | J               | 16   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| CD74HC137E       | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HC137EE4     | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HC137PW      | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC137PWE4    | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC137PWG4    | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC137PWR     | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC137PWRE4   | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC137PWRG4   | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC137PWT     | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC137PWTE4   | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC137PWTG4   | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237E       | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HC237EE4     | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HC237M       | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237M96     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237M96E4   | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237M96G4   | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237ME4     | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237MG4     | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237MT      | ACTIVE                | SOIC         | D               | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237MTE4    | ACTIVE                | SOIC         | D               | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237MTG4    | ACTIVE                | SOIC         | D               | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237NSR     | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| CD74HC237NSRE4   | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237NSRG4   | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PW      | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PWE4    | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PWG4    | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PWR     | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PWRE4   | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PWRG4   | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PWT     | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PWTE4   | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC237PWTG4   | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT137E      | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HCT137EE4    | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HCT137M96    | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT137M96E4  | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT137M96G4  | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT137MT     | ACTIVE                | SOIC         | D               | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT137MTE4   | ACTIVE                | SOIC         | D               | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT137MTG4   | ACTIVE                | SOIC         | D               | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT237E      | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HCT237EE4    | ACTIVE                | PDIP         | N               | 16   | 25          | 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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**TAPE AND REEL INFORMATION**



**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74HC137PWR  | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 7.0     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| CD74HC237M96  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| CD74HC237NSR  | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |
| CD74HC237PWR  | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 7.0     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| CD74HCT137M96 | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD74HC137PWR  | TSSOP        | PW              | 16   | 2000 | 346.0       | 346.0      | 29.0        |
| CD74HC237M96  | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |
| CD74HC237NSR  | SO           | NS              | 16   | 2000 | 346.0       | 346.0      | 33.0        |
| CD74HC237PWR  | TSSOP        | PW              | 16   | 2000 | 346.0       | 346.0      | 29.0        |
| CD74HCT137M96 | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |

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

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 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.

## MECHANICAL DATA

**NS (R-PDSO-G\*\*)**

**PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



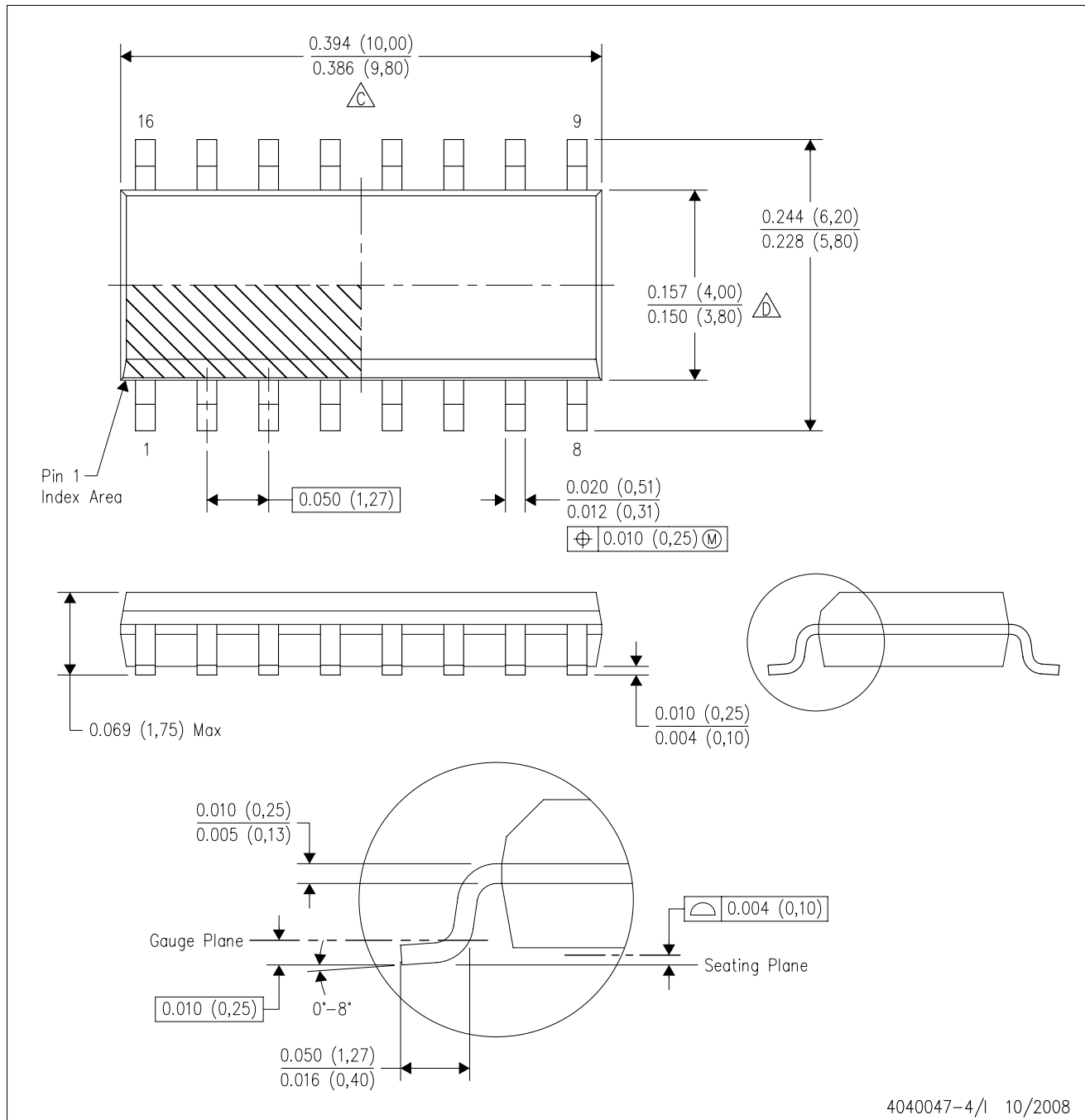
4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153



D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AC.

D(R-PDSO-G16)



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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

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