

# 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".

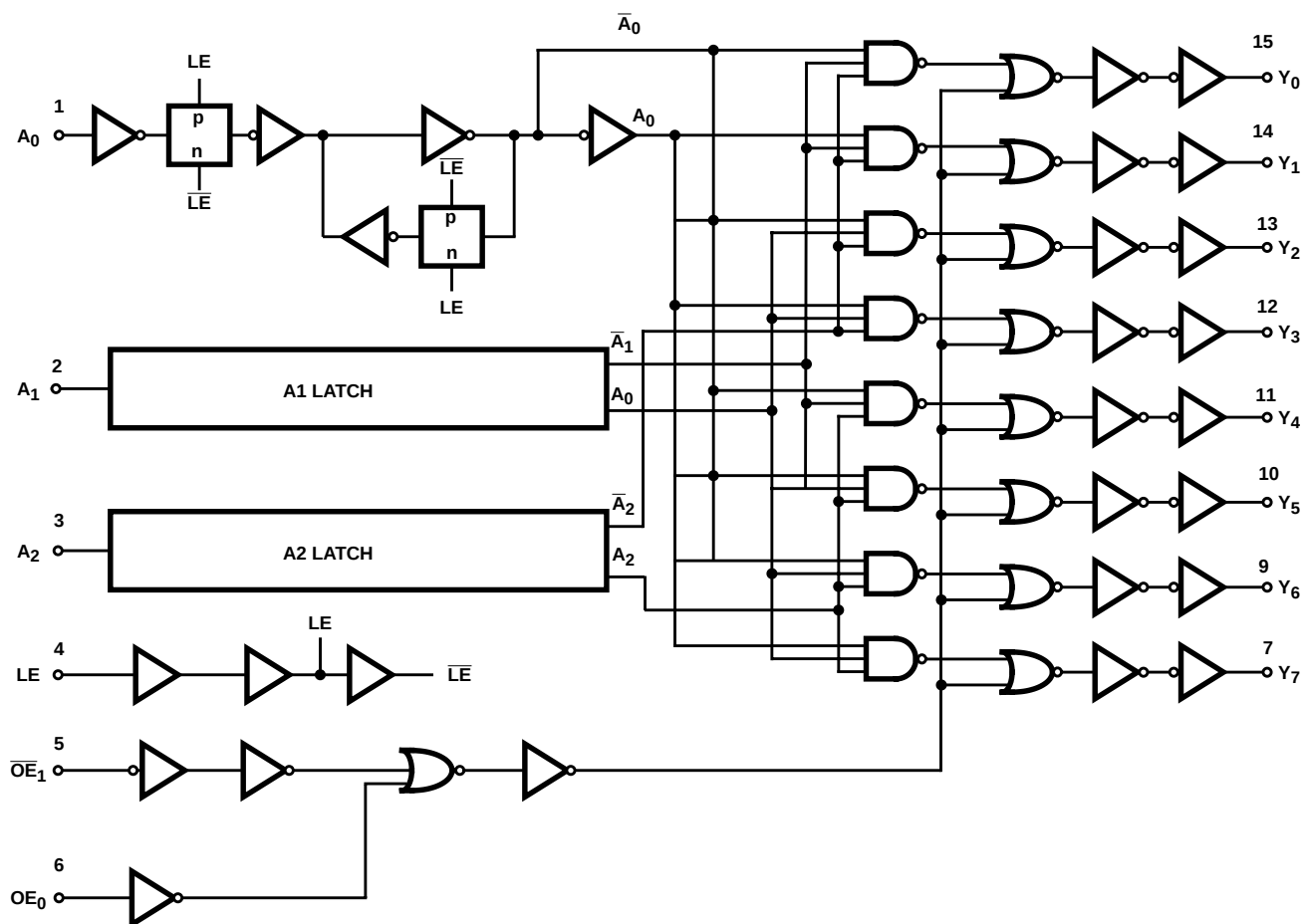
### Ordering Information

| 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.



### 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 .....  $67^{\circ}C/W$   
 M (SOIC) Package .....  $73^{\circ}C/W$   
 NS (SOP) Package .....  $64^{\circ}C/W$   
 PW (TSSOP) Package .....  $108^{\circ}C/W$   
 Maximum Junction Temperature .....  $150^{\circ}C$   
 Maximum Storage Temperature Range .....  $-65^{\circ}C$  to  $150^{\circ}C$   
 Maximum Lead Temperature (Soldering 10s) .....  $300^{\circ}C$   
 (SOIC - Lead Tips Only)

## Operating Conditions

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

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

## NOTE:

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

## DC Electrical Specifications

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

**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><br>(V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|---------------------------------|-----------------|------------------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                                 |                 |                        | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| HC TYPES                        |                 |                        |      |     |     |               |     |                |     |       |
| 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><br>(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    |
| HCT TYPES                        |                 |                        |      |     |     |               |     |                |     |       |
| An to LE Setup Time              | t <sub>SU</sub> | 4.5                    | 10   | -   | -   | 13            | -   | 15             | -   | ns    |
| An to LE Hold Time<br>CD74HCT137 | 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 |       |
| HC TYPES                                                              |                                     |                       |                     |      |     |     |               |     |                |     |       |
| Propagation Delay<br>CD74HC137, CD74HCT137<br><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><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    |
| $\overline{OE}_1$ 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  | -   | -             | -   | -              | -   | pF    |
| 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  | -             | 10  | -              | 10  | pF    |

# CD74HC137, CD74HCT137, CD54HC237, CD74HC237, CD74HCT237

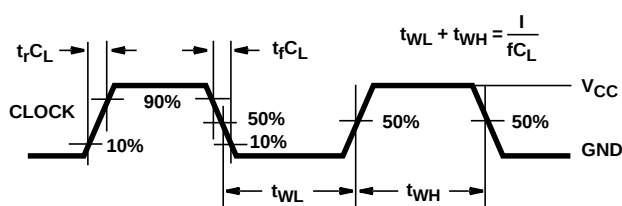
## Switching Specifications Input $t_r, t_f = 6\text{ns}$ (Continued)

| PARAMETER                                                          | SYMBOL             | TEST CONDITIONS       | V <sub>CC</sub> (V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|--------------------------------------------------------------------|--------------------|-----------------------|---------------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                                                                    |                    |                       |                     | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| HCT TYPES                                                          |                    |                       |                     |      |     |     |               |     |                |     |       |
| Propagation Delay<br>An to any $\bar{Y}$ or Y<br>Address to Output | $t_{PLH}, t_{PHL}$ | C <sub>L</sub> = 50pF | 4.5                 | -    | -   | 38  | -             | 48  | -              | 57  | ns    |
|                                                                    | $t_{PLH}, t_{PHL}$ | C <sub>L</sub> = 15pF | 5                   | -    | 16  | -   | -             | -   | -              | -   | ns    |
| OE <sub>0</sub> to any Y (HC137)                                   | $t_{PLH}, t_{PHL}$ | C <sub>L</sub> = 50pF | 4.5                 | -    | -   | 35  | -             | 44  | -              | 53  | ns    |
| OE <sub>0</sub> to any $\bar{Y}$ (HC237)                           | $t_{PLH}, t_{PHL}$ | C <sub>L</sub> = 50pF | 4.5                 | -    | -   | 33  | -             | 41  | -              | 60  | ns    |
| $\overline{OE}_1$ to any $\bar{Y}$ (HC137)                         | $t_{TLH}, t_{THL}$ | C <sub>L</sub> = 50pF | 4.5                 | -    | -   | 37  | -             | 46  | -              | 56  | ns    |
| $\overline{OE}_1$ to any $\bar{Y}$ (HC237)                         | $t_{TLH}, t_{THL}$ | C <sub>L</sub> = 50pF | 4.5                 | -    | -   | 35  | -             | 44  | -              | 53  | ns    |
| LE to any Y (HC137)                                                | $t_{TLH}, t_{THL}$ | CL = 50pF             | 4.5                 | -    | -   | 44  | -             | 55  | -              | 66  | ns    |
| LE to any $\bar{Y}$ (HC237)                                        | $t_{TLH}, t_{THL}$ | C <sub>L</sub> = 50pF | 4.5                 | -    | -   | 42  | -             | 53  | -              | 63  | ns    |
| Power Dissipation<br>Capacitance, (Notes 3, 4)                     |                    |                       |                     |      |     |     |               |     |                |     |       |
| 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  | -   | -             | -   | -              | -   | pF    |
| Output Transition Time                                             | $t_{TLH}, t_{THL}$ | C <sub>L</sub> = 50pF | 4.5                 |      |     | 15  |               | 19  |                | 22  | ns    |
| Input Capacitance                                                  | C <sub>I</sub>     | -                     | -                   | -    | -   | 10  | -             | 10  | -              | 10  | pF    |

### NOTES:

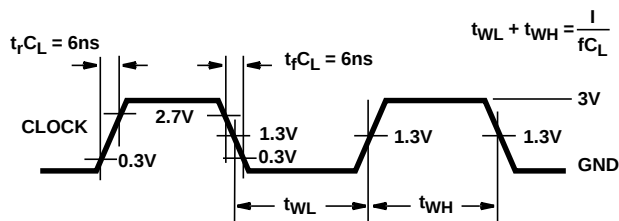
- $C_{PD}$  is used to determine the dynamic power consumption, per gate.
- $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where:  $f_i$  = Input Frequency,  $C_L$  = Output Load Capacitance,  $V_{CC}$  = Supply Voltage.

## 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

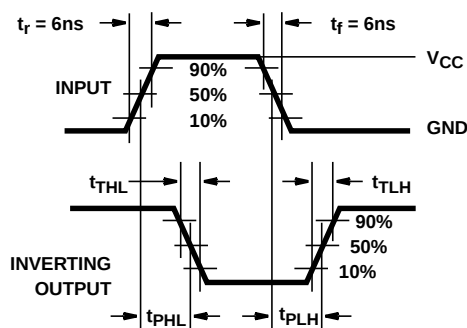


FIGURE 3. HC AND HCU TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

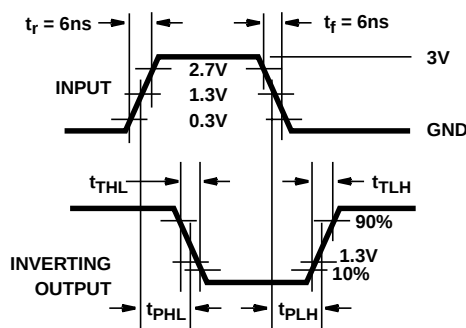


FIGURE 4. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC



**PACKAGING INFORMATION**

| Orderable part number          | Status<br>(1) | Material type<br>(2) | Package   Pins            | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)            |
|--------------------------------|---------------|----------------------|---------------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|--------------------------------|
| <a href="#">5962-8860601EA</a> | Active        | Production           | CDIP (J)   16             | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8860601EA<br>CD54HC237F3A |
| <a href="#">CD54HC237F</a>     | Active        | Production           | CDIP (J)   16             | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HC237F                     |
| CD54HC237F.A                   | Active        | Production           | CDIP (J)   16             | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HC237F                     |
| <a href="#">CD54HC237F3A</a>   | Active        | Production           | CDIP (J)   16             | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8860601EA<br>CD54HC237F3A |
| CD54HC237F3A.A                 | Active        | Production           | CDIP (J)   16             | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8860601EA<br>CD54HC237F3A |
| <a href="#">CD74HC137E</a>     | Active        | Production           | PDIP (N)   16             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC137E                     |
| CD74HC137E.A                   | Active        | Production           | PDIP (N)   16             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC137E                     |
| <a href="#">CD74HC137PW</a>    | Obsolete      | Production           | TSSOP (PW)   16           | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HJ137                          |
| <a href="#">CD74HC137PWR</a>   | Active        | Production           | TSSOP (PW)   16           | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HJ137                          |
| CD74HC137PWR.A                 | Active        | Production           | TSSOP (PW)   16           | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HJ137                          |
| <a href="#">CD74HC237DYYR</a>  | Active        | Production           | SOT-23-THIN<br>(DYY)   16 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | HJ237                          |
| CD74HC237DYYR.A                | Active        | Production           | SOT-23-THIN<br>(DYY)   16 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HJ237                          |
| <a href="#">CD74HC237E</a>     | Active        | Production           | PDIP (N)   16             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC237E                     |
| CD74HC237E.A                   | Active        | Production           | PDIP (N)   16             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC237E                     |
| CD74HC237EE4                   | Active        | Production           | PDIP (N)   16             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC237E                     |
| <a href="#">CD74HC237M</a>     | Obsolete      | Production           | SOIC (D)   16             | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HC237M                         |
| <a href="#">CD74HC237M96</a>   | Active        | Production           | SOIC (D)   16             | 2500   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -55 to 125   | HC237M                         |
| CD74HC237M96.A                 | Active        | Production           | SOIC (D)   16             | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC237M                         |
| CD74HC237M961G4.A              | Active        | Production           | SOIC (D)   16             | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC237M                         |
| <a href="#">CD74HC237NSR</a>   | Active        | Production           | SOP (NS)   16             | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC237M                         |
| CD74HC237NSR.A                 | Active        | Production           | SOP (NS)   16             | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC237M                         |
| <a href="#">CD74HC237PWR</a>   | Active        | Production           | TSSOP (PW)   16           | 2000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -55 to 125   | HJ237                          |
| CD74HC237PWR.A                 | Active        | Production           | TSSOP (PW)   16           | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HJ237                          |
| <a href="#">CD74HC237PWT</a>   | Obsolete      | Production           | TSSOP (PW)   16           | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HJ237                          |
| <a href="#">CD74HCT137E</a>    | Active        | Production           | PDIP (N)   16             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT137E                    |

| Orderable part number         | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| CD74HCT137E.A                 | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT137E         |
| <a href="#">CD74HCT137M96</a> | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT137M             |
| CD74HCT137M96.A               | Active        | Production           | SOIC (D)   16  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT137M             |
| <a href="#">CD74HCT137MT</a>  | Obsolete      | Production           | SOIC (D)   16  | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | HCT137M             |
| <a href="#">CD74HCT237E</a>   | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT237E         |
| CD74HCT237E.A                 | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT237E         |

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

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

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

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

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

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

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

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

**OTHER QUALIFIED VERSIONS OF CD54HC237, CD74HC237 :**

- Catalog : [CD74HC237](#)
- Military : [CD54HC237](#)

NOTE: Qualified Version Definitions:

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

## TAPE AND REEL INFORMATION



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74HC137PWR  | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| CD74HC237DYYR | SOT-23-THIN  | DYY             | 16   | 3000 | 330.0              | 12.4               | 4.8     | 3.6     | 1.6     | 8.0     | 12.0   | Q3            |
| CD74HC237M96  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.6     | 9.3     | 2.1     | 8.0     | 16.0   | Q1            |
| CD74HC237M96  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| CD74HC237NSR  | SOP          | 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               | 6.9     | 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 | 356.0       | 356.0      | 35.0        |
| CD74HC237DYYR | SOT-23-THIN  | DYY             | 16   | 3000 | 336.6       | 336.6      | 31.8        |
| CD74HC237M96  | SOIC         | D               | 16   | 2500 | 366.0       | 364.0      | 50.0        |
| CD74HC237M96  | SOIC         | D               | 16   | 2500 | 356.0       | 356.0      | 35.0        |
| CD74HC237NSR  | SOP          | NS              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| CD74HC237PWR  | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| CD74HCT137M96 | SOIC         | D               | 16   | 2500 | 353.0       | 353.0      | 32.0        |

**TUBE**


\*All dimensions are nominal

| Device        | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|---------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| CD74HC137E    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC137E    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC137E.A  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC137E.A  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC237E    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC237E    | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC237E.A  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC237E.A  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC237EE4  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC237EE4  | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT137E   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT137E   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT137E.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT137E.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT237E   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT237E   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT237E.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT237E.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |



# PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

## NOTES:

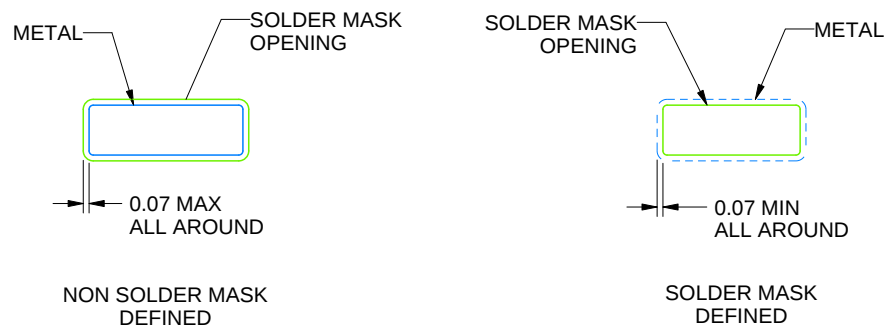
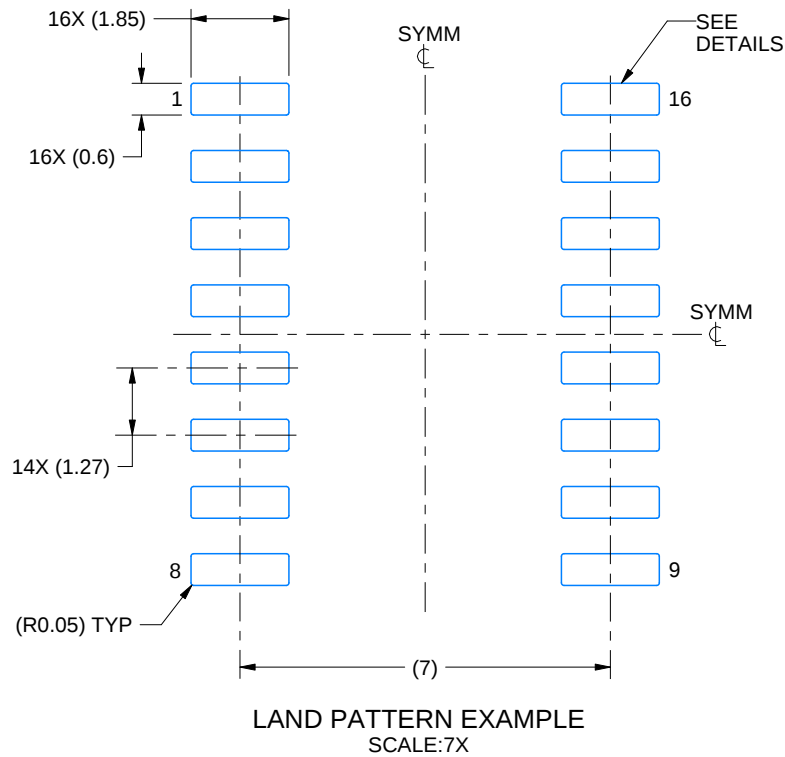
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

# EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE  
 BASED ON 0.125 mm THICK STENCIL  
 SCALE:7X

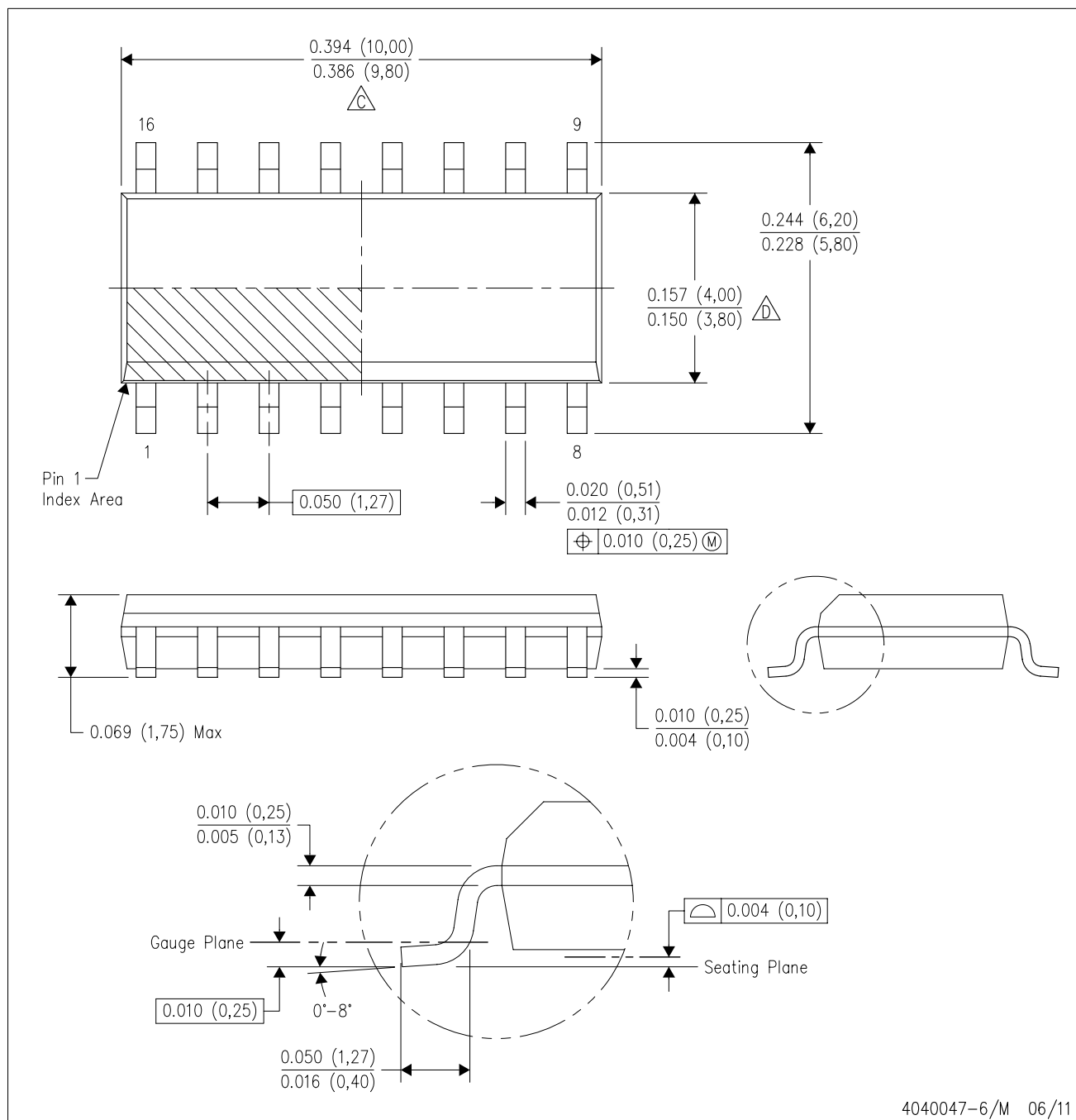
4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



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



4220204/A 02/2017

## NOTES:

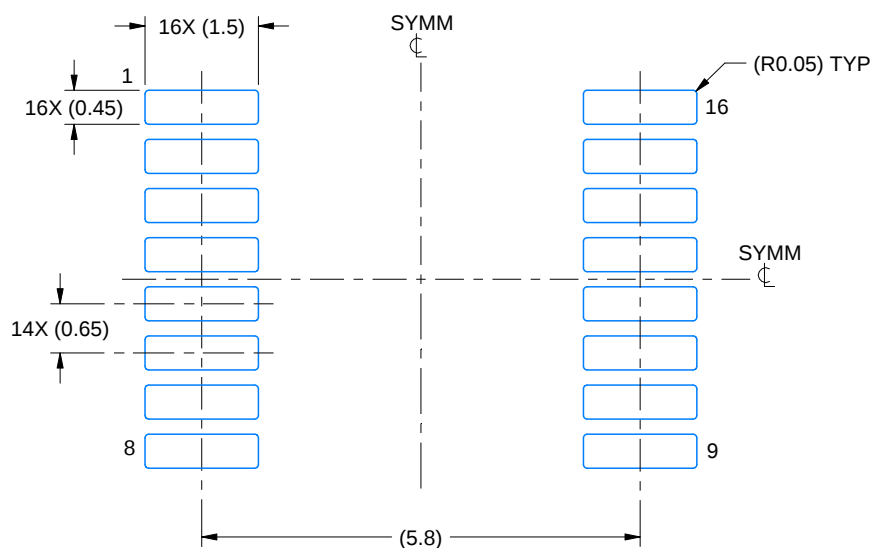
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

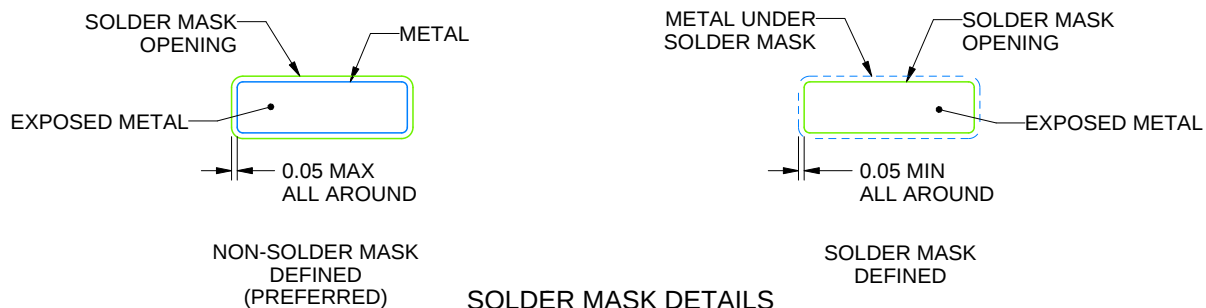
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220204/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220204/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# MECHANICAL DATA

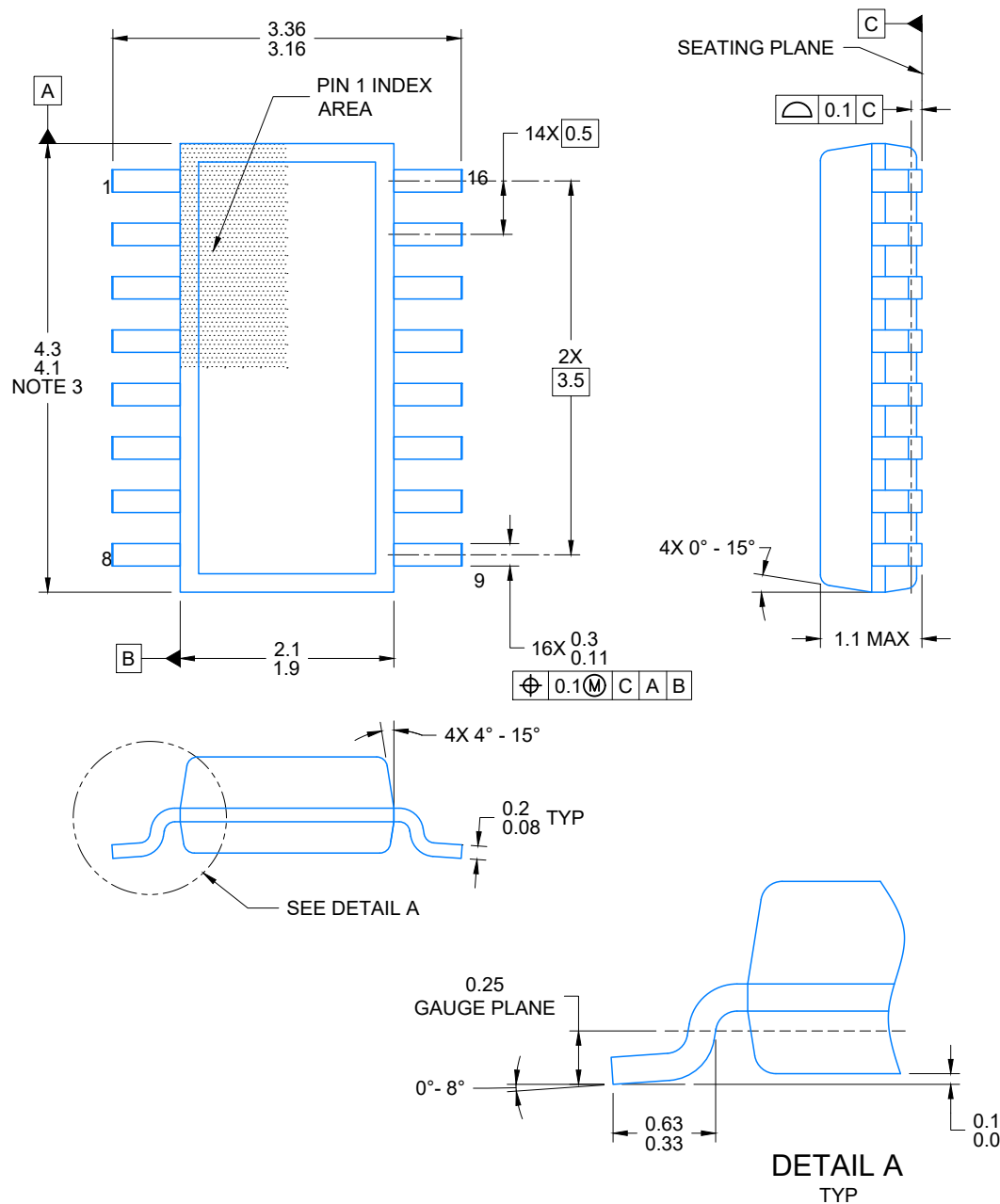
NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



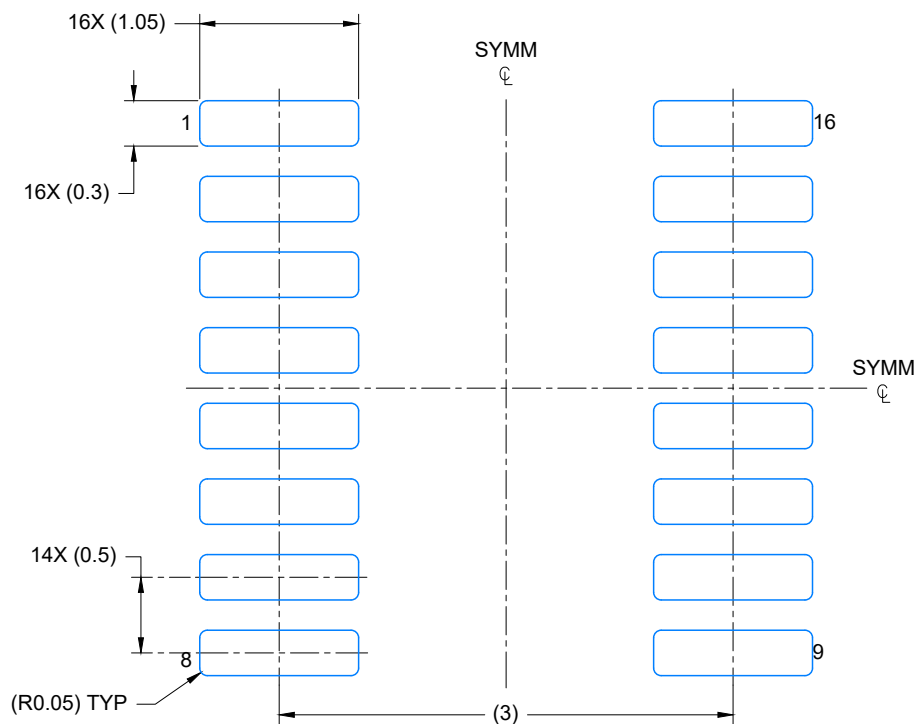
- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



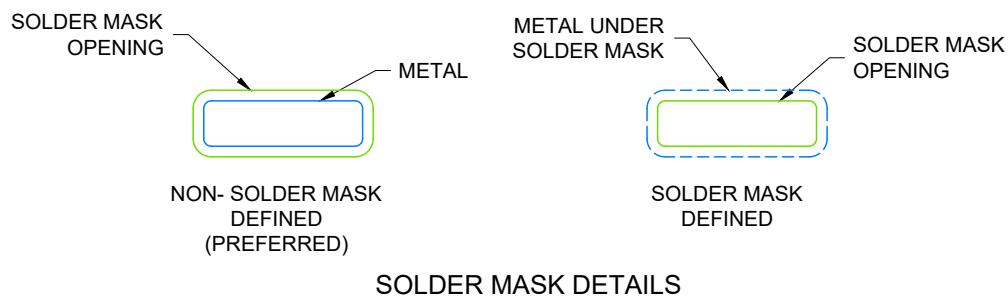
4224642/D 07/2024

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
5. Reference JEDEC Registration MO-345, Variation AA



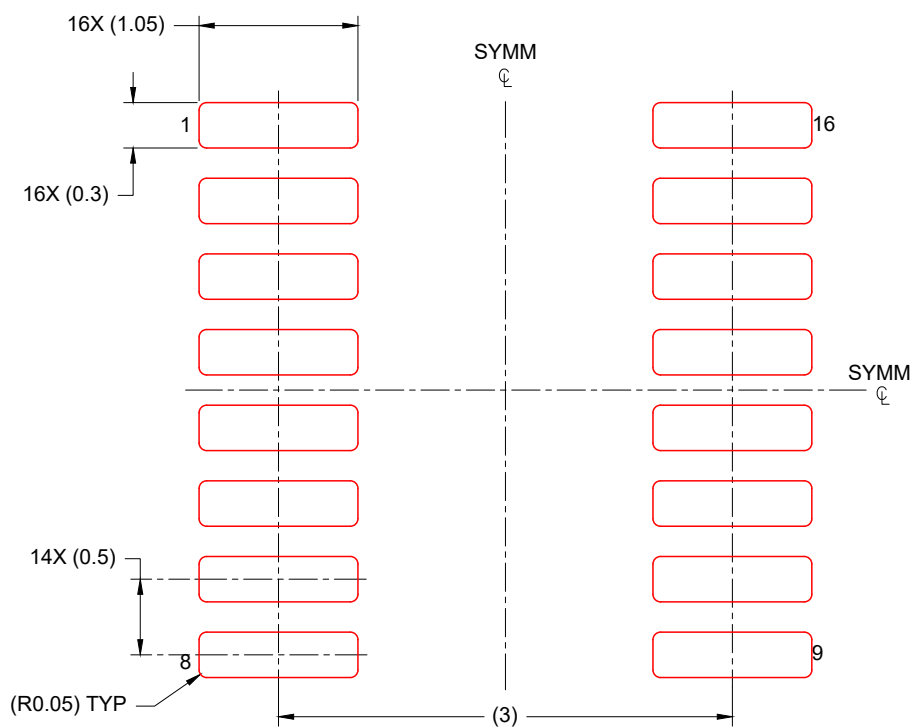
LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 20X



4224642/D 07/2024

## NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 20X

4224642/D 07/2024

## NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



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



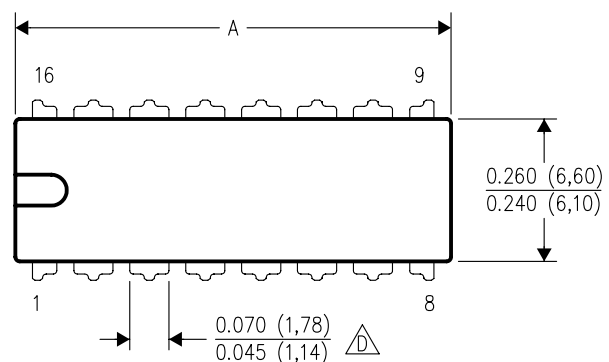
4040083/F 03/03

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

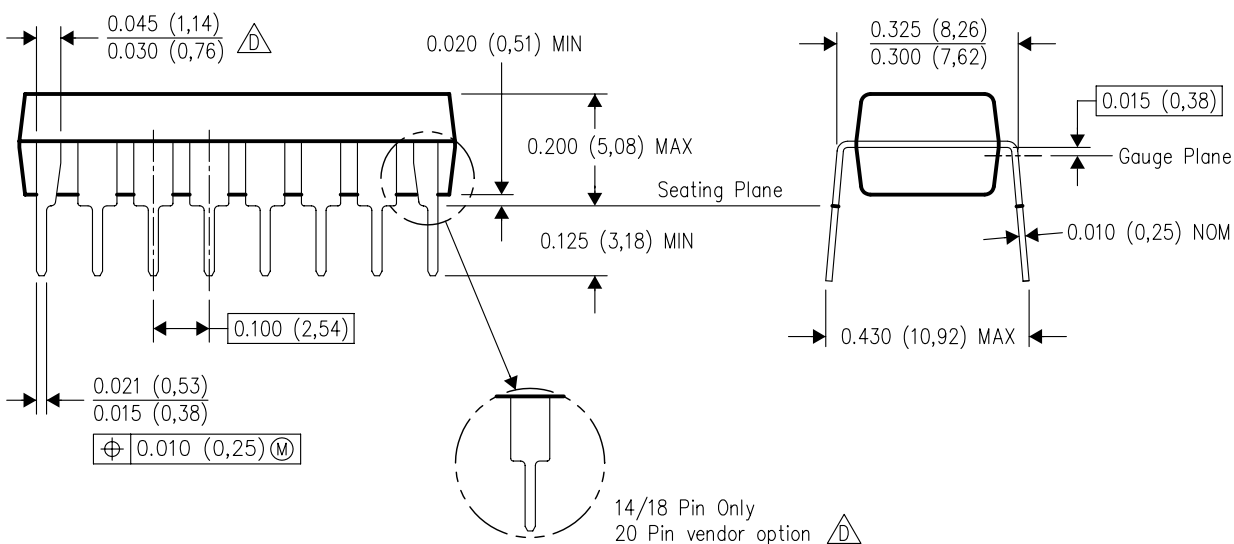
N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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



4040049/E 12/2002

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

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