

# HD74HC138

3-to-8-line Decoder/Demultiplexer

# HITACHI

ADE-205-444 (Z)  
1st. Edition  
Sep. 2000

## Description

The HD74HC138 has 3 binary select inputs (A, B and C). If the device is enabled these inputs determine which one of the eight normally high outputs will go low. Two active low and one active high enables ( $G_1$ ,  $G_{2A}$  and  $G_{2B}$ ) are provided to ease the cascading of decoders.

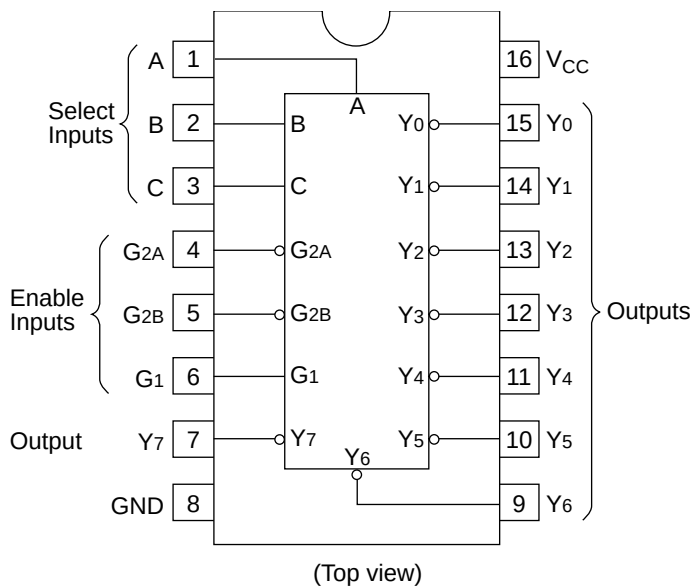
## Features

- High Speed Operation:  $t_{pd}$  (A, B, C to Y) = 16.5 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage:  $V_{CC} = 2$  V to 6 V
- Low Input Current: 1  $\mu$ A max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )

## Function Table

| Inputs |                 |                 |        |   |   |                |                |                |                |                |                |                |                |
|--------|-----------------|-----------------|--------|---|---|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Enable |                 |                 | Select |   |   | Outputs        |                |                |                |                |                |                |                |
| G1     | G <sub>2A</sub> | G <sub>2B</sub> | C      | B | A | 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      | H               | X               | X      | X | X | H              | H              | H              | H              | H              | H              | H              | H              |
| L      | X               | X               | X      | X | X | H              | H              | H              | H              | H              | H              | H              | H              |
| H      | L               | L               | L      | L | L | L              | H              | H              | H              | H              | H              | H              | H              |
| H      | L               | L               | L      | L | H | H              | L              | H              | H              | H              | H              | H              | H              |
| H      | L               | L               | L      | H | L | H              | H              | L              | H              | H              | H              | H              | H              |
| H      | L               | L               | L      | H | H | H              | H              | H              | L              | H              | H              | H              | H              |
| H      | L               | L               | H      | L | L | H              | H              | H              | H              | L              | H              | H              | H              |
| H      | L               | L               | H      | L | H | H              | H              | H              | H              | H              | L              | H              | H              |
| H      | L               | L               | H      | H | L | H              | H              | H              | H              | H              | H              | L              | H              |
| H      | L               | L               | H      | H | H | H              | H              | H              | H              | H              | H              | H              | L              |

### Pin Arrangement



## DC Characteristics

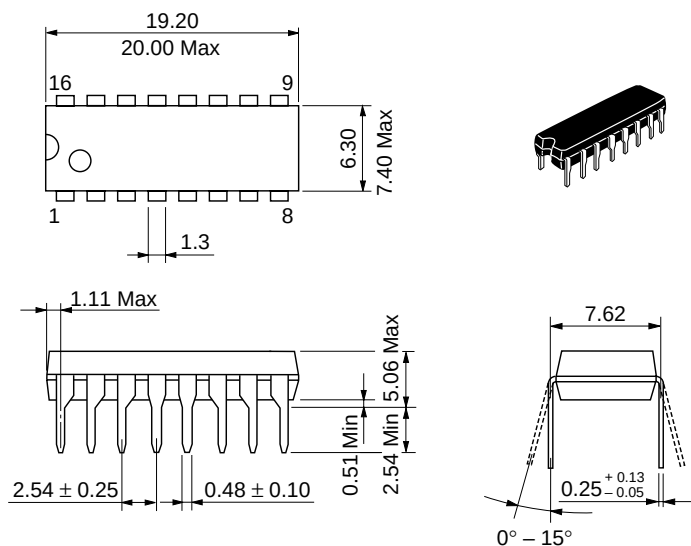
| Item                     | Symbol          | V <sub>CC</sub> (V) | Ta = 25°C |     |      | Ta = −40 to +85°C |      | Unit | Test Conditions                                                   |                           |
|--------------------------|-----------------|---------------------|-----------|-----|------|-------------------|------|------|-------------------------------------------------------------------|---------------------------|
|                          |                 |                     | Min       | Typ | Max  | Min               | Max  |      |                                                                   |                           |
| Input voltage            | V <sub>IH</sub> | 2.0                 | 1.5       | —   | —    | 1.5               | —    | V    |                                                                   |                           |
|                          |                 | 4.5                 | 3.15      | —   | —    | 3.15              | —    |      |                                                                   |                           |
|                          |                 | 6.0                 | 4.2       | —   | —    | 4.2               | —    |      |                                                                   |                           |
|                          | V <sub>IL</sub> | 2.0                 | —         | —   | 0.5  | —                 | 0.5  | V    |                                                                   |                           |
|                          |                 | 4.5                 | —         | —   | 1.35 | —                 | 1.35 |      |                                                                   |                           |
|                          |                 | 6.0                 | —         | —   | 1.8  | —                 | 1.8  |      |                                                                   |                           |
| Output voltage           | V <sub>OH</sub> | 2.0                 | 1.9       | 2.0 | —    | 1.9               | —    | V    | Vin = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = −20 μA |                           |
|                          |                 | 4.5                 | 4.4       | 4.5 | —    | 4.4               | —    |      |                                                                   |                           |
|                          |                 | 6.0                 | 5.9       | 6.0 | —    | 5.9               | —    |      |                                                                   |                           |
|                          |                 | 4.5                 | 4.18      | —   | —    | 4.13              | —    |      |                                                                   | I <sub>OH</sub> = −4 mA   |
|                          |                 | 6.0                 | 5.68      | —   | —    | 5.63              | —    |      |                                                                   | I <sub>OH</sub> = −5.2 mA |
|                          | V <sub>OL</sub> | 2.0                 | —         | 0.0 | 0.1  | —                 | 0.1  | V    | Vin = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 20 μA  |                           |
|                          |                 | 4.5                 | —         | 0.0 | 0.1  | —                 | 0.1  |      |                                                                   |                           |
|                          |                 | 6.0                 | —         | 0.0 | 0.1  | —                 | 0.1  |      |                                                                   |                           |
|                          |                 | 4.5                 | —         | —   | 0.26 | —                 | 0.33 |      |                                                                   | I <sub>OL</sub> = 4 mA    |
|                          |                 | 6.0                 | —         | —   | 0.26 | —                 | 0.33 |      |                                                                   | I <sub>OL</sub> = 5.2 mA  |
| Input current            | I <sub>in</sub> | 6.0                 | —         | —   | ±0.1 | —                 | ±1.0 | μA   | Vin = V <sub>CC</sub> or GND                                      |                           |
| Quiescent supply current | I <sub>CC</sub> | 6.0                 | —         | —   | 4.0  | —                 | 40   | μA   | Vin = V <sub>CC</sub> or GND, I <sub>out</sub> = 0 μA             |                           |

AC Characteristics (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

| Item                   | Symbol           | V <sub>CC</sub> (V) | Ta = 25°C |     | Ta = −40 to +85°C |     | Unit | Test Conditions |                                              |
|------------------------|------------------|---------------------|-----------|-----|-------------------|-----|------|-----------------|----------------------------------------------|
|                        |                  |                     | Min       | Typ | Max               | Min |      |                 | Max                                          |
| Propagation delay time | t <sub>PHL</sub> | 2.0                 | —         | —   | 175               | —   | 220  | ns              | A, B or C to Output                          |
|                        |                  | 4.5                 | —         | 17  | 35                | —   | 44   |                 |                                              |
|                        |                  | 6.0                 | —         | —   | 30                | —   | 37   |                 |                                              |
|                        | t <sub>PLH</sub> | 2.0                 | —         | —   | 150               | —   | 190  | ns              |                                              |
|                        |                  | 4.5                 | —         | 16  | 30                | —   | 38   |                 |                                              |
|                        |                  | 6.0                 | —         | —   | 26                | —   | 33   |                 |                                              |
|                        | t <sub>PHL</sub> | 2.0                 | —         | —   | 150               | —   | 190  | ns              | G <sub>1</sub> to Output                     |
|                        |                  | 4.5                 | —         | 16  | 30                | —   | 38   |                 |                                              |
|                        |                  | 6.0                 | —         | —   | 26                | —   | 33   |                 |                                              |
|                        | t <sub>PLH</sub> | 2.0                 | —         | —   | 150               | —   | 190  | ns              |                                              |
|                        |                  | 4.5                 | —         | 17  | 30                | —   | 38   |                 |                                              |
|                        |                  | 6.0                 | —         | —   | 26                | —   | 33   |                 |                                              |
|                        | t <sub>PHL</sub> | 2.0                 | —         | —   | 175               | —   | 220  | ns              | G <sub>2A</sub> or G <sub>2B</sub> to Output |
|                        |                  | 4.5                 | —         | 15  | 35                | —   | 44   |                 |                                              |
|                        |                  | 6.0                 | —         | —   | 30                | —   | 37   |                 |                                              |
|                        | t <sub>PLH</sub> | 2.0                 | —         | —   | 150               | —   | 190  | ns              |                                              |
|                        |                  | 4.5                 | —         | 17  | 30                | —   | 38   |                 |                                              |
|                        |                  | 6.0                 | —         | —   | 26                | —   | 33   |                 |                                              |
| Output rise/fall time  | t <sub>TLH</sub> | 2.0                 | —         | —   | 75                | —   | 95   | ns              |                                              |
|                        | t <sub>THL</sub> | 4.5                 | —         | 5   | 15                | —   | 19   |                 |                                              |
|                        |                  | 6.0                 | —         | —   | 13                | —   | 16   |                 |                                              |
| Input capacitance      | C <sub>in</sub>  | —                   | —         | 5   | 10                | —   | 10   | pF              |                                              |

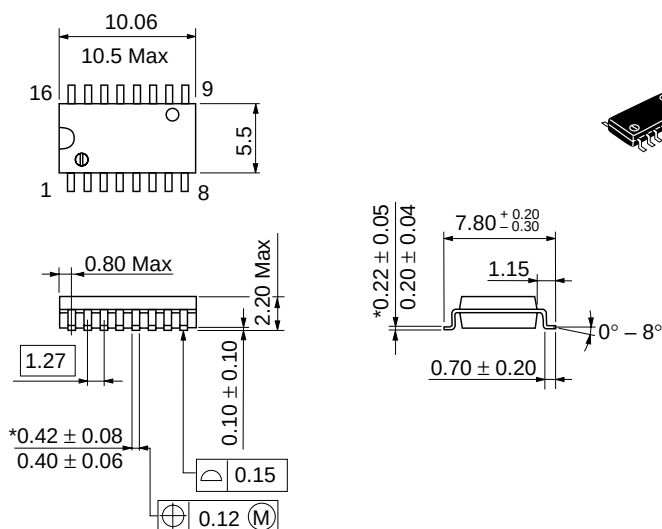
## Package Dimensions

Unit: mm



|                        |          |
|------------------------|----------|
| Hitachi Code           | DP-16    |
| JEDEC                  | Conforms |
| EIAJ                   | Conforms |
| Mass (reference value) | 1.07 g   |

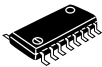
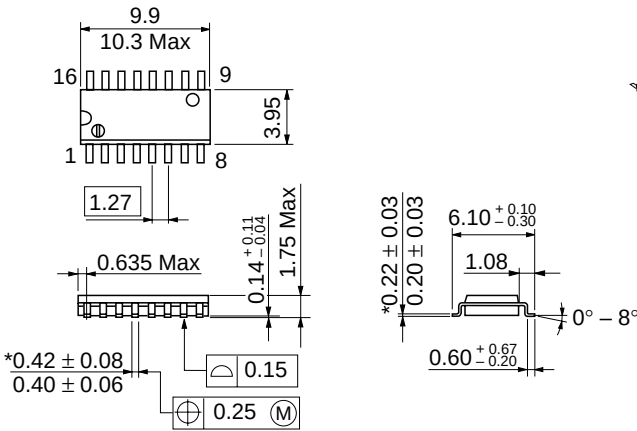
Unit: mm



|                        |          |
|------------------------|----------|
| Hitachi Code           | FP-16DA  |
| JEDEC                  | —        |
| EIAJ                   | Conforms |
| Mass (reference value) | 0.24 g   |

$$\frac{\text{*Dimension including the plating thickness}}{\text{Base material dimension}}$$

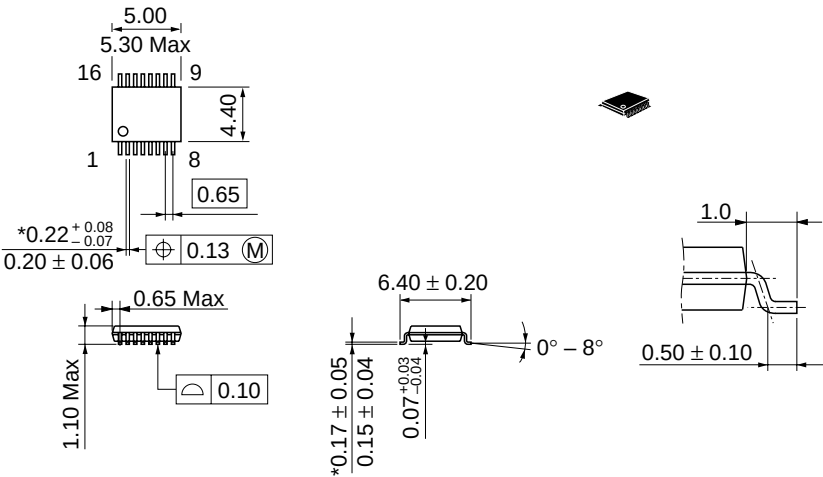
Unit: mm



\*Dimension including the plating thickness  
Base material dimension

|                        |          |
|------------------------|----------|
| Hitachi Code           | FP-16DN  |
| JEDEC                  | Conforms |
| EIAJ                   | Conforms |
| Mass (reference value) | 0.15 g   |

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

|                        |          |
|------------------------|----------|
| Hitachi Code           | TTP-16DA |
| JEDEC                  | —        |
| EIAJ                   | —        |
| Mass (reference value) | 0.05 g   |

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## Hitachi, Ltd.

Semiconductor & Integrated Circuits.  
Nippon Bldg., 2-6-2, Ohite-machi, Chiyoda-ku, Tokyo 100-0004, Japan  
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

|     |               |                                                                                               |
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### For further information write to:

|                                                                                                                                            |                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hitachi Semiconductor (America) Inc.<br>179 East Tasman Drive,<br>San Jose, CA 95134<br>Tel: <1> (408) 433-1990<br>Fax: <1> (408) 433-0223 | Hitachi Europe GmbH<br>Electronic Components Group<br>Dornacher Straße 3<br>D-85622 Feldkirchen, Munich<br>Germany<br>Tel: <49> (89) 9 9180-0<br>Fax: <49> (89) 9 29 30 00                            |
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Hitachi Asia (Hong Kong) Ltd.  
Group III (Electronic Components)  
7/F., North Tower,  
World Finance Centre,  
Harbour City, Canton Road  
Tsim Sha Tsui, Kowloon,  
Hong Kong  
Tel: <852>-(2)-735-9218  
Fax: <852>-(2)-730-0281  
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