

TC74HC139AP, TC74HC139AF, TC74HC139AFN

DUAL 2-TO-4 LINE DECODER

The TC74HC139A is a high speed CMOS 2 - to - 4 LINE DECODER / DEMULTIPLEXER fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

The active low enable input can be used for gating or it can be used as a data input for demultiplexing applications.

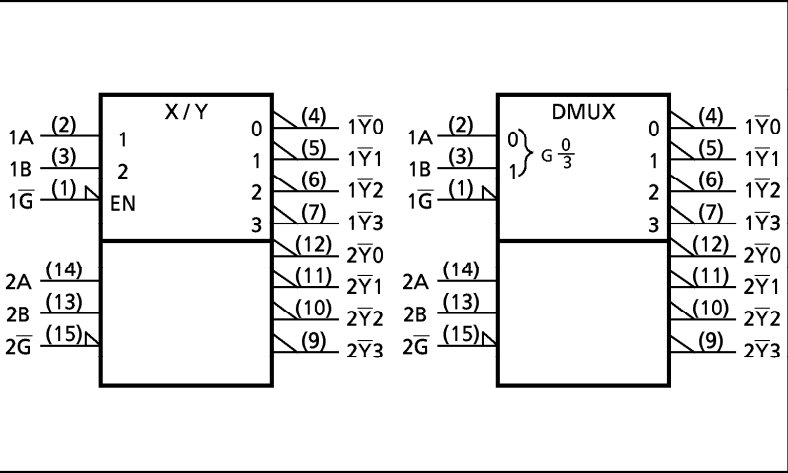
When the enable input is held "H", all four outputs are fixed at a high logic level independent of the other inputs.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

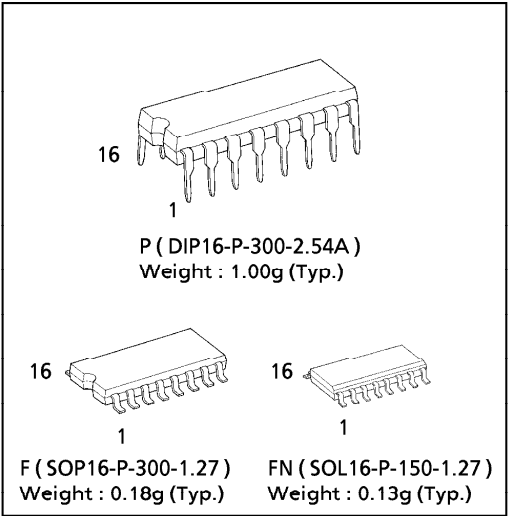
FEATURES :

- High Speed..... $t_{pd} = 16\text{ns}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}(\text{Min.})$
- Output Drive Capability..... 10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{OH}| = I_{OL} = 4\text{mA}(\text{Min.})$
- Balanced Propagation Delays.....  $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range....  $V_{CC}(\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS139

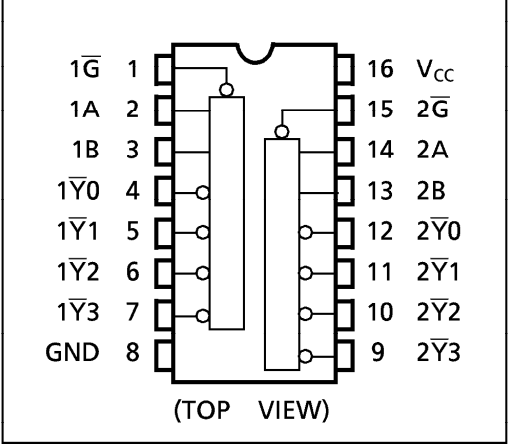
IEC LOGIC SYMBOL



(Note) The JEDEC SOP (FN) is not available in Japan.



PIN ASSIGNMENT



TRUTH TABLE

| INPUTS |        |   | OUTPUTS |    |    |    | SELECTED OUTPUT |
|--------|--------|---|---------|----|----|----|-----------------|
| ENABLE | SELECT |   | Y0      | Y1 | Y2 | Y3 |                 |
| G      | B      | A | Y0      | Y1 | Y2 | Y3 |                 |
| H      | X      | X | H       | H  | H  | H  | NONE            |
| L      | L      | L | L       | H  | H  | H  | Y0              |
| L      | L      | H | H       | L  | H  | H  | Y1              |
| L      | H      | L | H       | H  | L  | H  | Y2              |
| L      | H      | H | H       | H  | H  | L  | Y3              |

X : Don't Care

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## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                    | SYMBOL    | VALUE                    | UNIT |
|------------------------------|-----------|--------------------------|------|
| Supply Voltage Range         | $V_{CC}$  | $-0.5 \sim 7$            | V    |
| DC Input Voltage             | $V_{IN}$  | $-0.5 \sim V_{CC} + 0.5$ | V    |
| DC Output Voltage            | $V_{OUT}$ | $-0.5 \sim V_{CC} + 0.5$ | V    |
| Input Diode Current          | $I_{IK}$  | $\pm 20$                 | mA   |
| Output Diode Current         | $I_{OK}$  | $\pm 20$                 | mA   |
| DC Output Current            | $I_{OUT}$ | $\pm 25$                 | mA   |
| DC $V_{CC}$ / Ground Current | $I_{CC}$  | $\pm 50$                 | mA   |
| Power Dissipation            | $P_D$     | 500 (DIP)* / 180 (SOP)   | mW   |
| Storage Temperature          | $T_{stg}$ | $-65 \sim 150$           | °C   |

\*500mW in the range of  $T_a = -40^\circ\text{C} \sim 65^\circ\text{C}$ . From  $T_a = 65^\circ\text{C}$  to  $85^\circ\text{C}$  a derating factor of  $-10\text{mW}/^\circ\text{C}$  shall be applied until 300mW.

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL     | VALUE                                                                                                              | UNIT |
|--------------------------|------------|--------------------------------------------------------------------------------------------------------------------|------|
| Supply Voltage           | $V_{CC}$   | $2 \sim 6$                                                                                                         | V    |
| Input Voltage            | $V_{IN}$   | $0 \sim V_{CC}$                                                                                                    | V    |
| Output Voltage           | $V_{OUT}$  | $0 \sim V_{CC}$                                                                                                    | V    |
| Operating Temperature    | $T_{opr}$  | $-40 \sim 85$                                                                                                      | °C   |
| Input Rise and Fall Time | $t_r, t_f$ | $0 \sim 1000 (V_{CC} = 2.0\text{V})$<br>$0 \sim 500 (V_{CC} = 4.5\text{V})$<br>$0 \sim 400 (V_{CC} = 6.0\text{V})$ | ns   |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                   | SYMBOL   | TEST CONDITION                       | $V_{CC}$<br>(V)            | $T_a = 25^\circ\text{C}$ |                   |                      | $T_a = -40 \sim 85^\circ\text{C}$ |                      | UNIT          |
|-----------------------------|----------|--------------------------------------|----------------------------|--------------------------|-------------------|----------------------|-----------------------------------|----------------------|---------------|
|                             |          |                                      |                            | MIN.                     | TYP.              | MAX.                 | MIN.                              | MAX.                 |               |
| High - Level Input Voltage  | $V_{IH}$ |                                      | 2.0<br>4.5<br>6.0          | 1.50<br>3.15<br>4.20     | —<br>—<br>—       | —<br>—<br>—          | 1.50<br>3.15<br>4.20              | —<br>—<br>—          | V             |
| Low - Level Input Voltage   | $V_{IL}$ |                                      | 2.0<br>4.5<br>6.0          | —<br>—<br>—              | —<br>—<br>—       | 0.50<br>1.35<br>1.80 | —<br>—<br>—                       | 0.50<br>1.35<br>1.80 | V             |
| High - Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OH} = -20\mu\text{A}$  | 2.0<br>4.5<br>6.0        | 1.9<br>4.4<br>5.9 | 2.0<br>4.5<br>6.0    | —<br>—<br>—                       | 1.9<br>4.4<br>5.9    | V             |
|                             |          |                                      | $I_{OH} = -4 \text{ mA}$   | 4.5<br>6.0               | 4.18<br>5.68      | 4.31<br>5.80         | —<br>—                            | 4.13<br>5.63         |               |
|                             |          |                                      | $I_{OH} = -5.2 \text{ mA}$ | 6.0                      | 5.68              | 5.80                 | —                                 | 5.63                 |               |
| Low - Level Output Voltage  | $V_{OL}$ | $V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OL} = 20\mu\text{A}$   | 2.0<br>4.5<br>6.0        | —<br>—<br>—       | 0.0<br>0.0<br>0.1    | —<br>—<br>—                       | 0.1<br>0.1<br>0.1    | V             |
|                             |          |                                      | $I_{OL} = 4 \text{ mA}$    | 4.5<br>6.0               | —<br>—            | 0.17<br>0.18         | —<br>—                            | 0.33<br>0.33         |               |
|                             |          |                                      | $I_{OL} = 5.2 \text{ mA}$  | 6.0                      | —                 | 0.26<br>0.26         | —<br>—                            | 0.33<br>0.33         |               |
| Input Leakage Current       | $I_{IN}$ | $V_{IN} = V_{CC} \text{ or GND}$     | 6.0                        | —                        | —                 | $\pm 0.1$            | —                                 | $\pm 1.0$            | $\mu\text{A}$ |
| Quiescent Supply Current    | $I_{CC}$ | $V_{IN} = V_{CC} \text{ or GND}$     | 6.0                        | —                        | —                 | 4.0                  | —                                 | 40.0                 |               |

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AC ELECTRICAL CHARACTERISTICS (  $C_L = 15\text{pF}$ ,  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$ , Input  $t_r = t_f = 6\text{ns}$  )

| PARAMETER                                           | SYMBOL                 | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------------------------------------|------------------------|----------------|------|------|------|------|
| Output Transition Time                              | $t_{TLH}$<br>$t_{THL}$ |                | —    | 4    | 8    | ns   |
| Propagation Delay Time<br>(A, B— $\bar{Y}$ )        | $t_{PLH}$<br>$t_{PHL}$ |                | —    | 12   | 22   |      |
| Propagation Delay Time<br>( $\bar{G}$ — $\bar{Y}$ ) | $t_{PLH}$<br>$t_{PHL}$ |                | —    | 10   | 18   |      |

AC ELECTRICAL CHARACTERISTICS (  $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$  )

| PARAMETER                           | SYMBOL                               | TEST CONDITION | Ta = 25°C           |      |      |      | Ta = −40–85°C |      | UNIT |
|-------------------------------------|--------------------------------------|----------------|---------------------|------|------|------|---------------|------|------|
|                                     |                                      |                | V <sub>CC</sub> (V) | MIN. | TYP. | MAX. | MIN.          | MAX. |      |
| Output Transition Time              | t <sub>TLH</sub><br>t <sub>THL</sub> |                | 2.0                 | —    | 30   | 75   | —             | 95   | ns   |
|                                     |                                      |                | 4.5                 | —    | 8    | 15   | —             | 19   |      |
|                                     |                                      |                | 6.0                 | —    | 7    | 13   | —             | 16   |      |
| Propagation Delay Time<br>(A, B—Y̅) | t <sub>pLH</sub><br>t <sub>pHL</sub> |                | 2.0                 | —    | 45   | 130  | —             | 165  |      |
|                                     |                                      |                | 4.5                 | —    | 15   | 26   | —             | 33   |      |
|                                     |                                      |                | 6.0                 | —    | 13   | 22   | —             | 28   |      |
| Propagation Delay Time<br>(G̅—Y̅)   | t <sub>pHL</sub>                     |                | 2.0                 | —    | 39   | 110  | —             | 140  |      |
|                                     |                                      |                | 4.5                 | —    | 13   | 22   | —             | 28   |      |
|                                     |                                      |                | 6.0                 | —    | 11   | 19   | —             | 24   |      |
| Input Capacitance                   | C <sub>IN</sub>                      |                | —                   | 5    | 10   | —    | 10            | pF   |      |
| Power Dissipation Capacitance       | C <sub>PD</sub> (1)                  |                | —                   | 46   | —    | —    | —             |      |      |

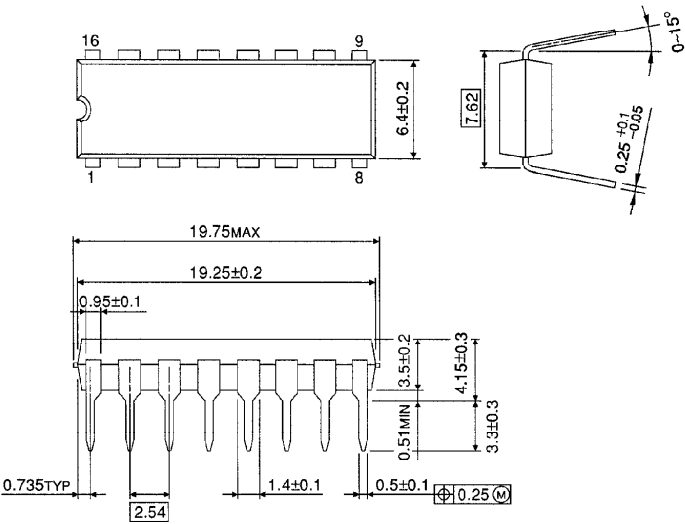
Note (1)  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2 \text{ (per Decoder)}$$

DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A )

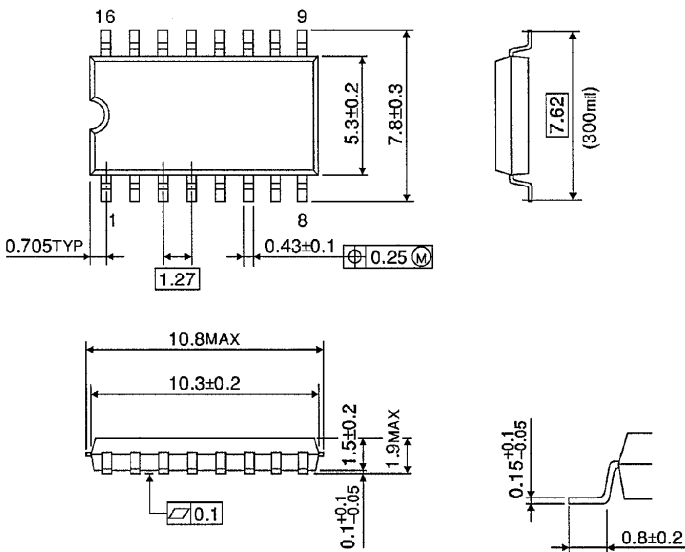
Unit in mm



Weight : 1.00g (Typ.)

SOP 16PIN ( 200mil BODY ) OUTLINE DRAWING ( SOP16-P-300-1.27 )

Unit in mm

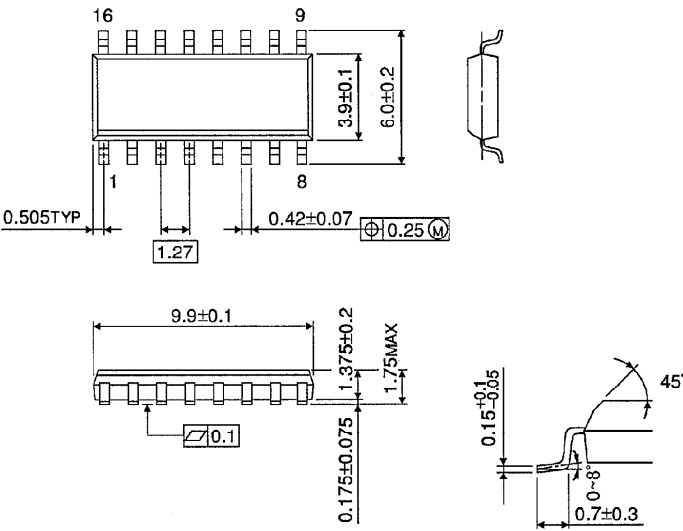


Weight : 0.18g (Typ.)

SOP 16PIN ( 150mil BODY ) OUTLINE DRAWING ( SOL14-P-150 -1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)