

TC74AC139P, TC74AC139F, TC74AC139FN, TC74AC139FT

DUAL 2 - TO - 4 LINE DECODER

The TC74AC139 is an advanced high speed CMOS 2 - to - 4 LINE DECODER fabricated with silicon gate and double - layer metal wiring C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL 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.

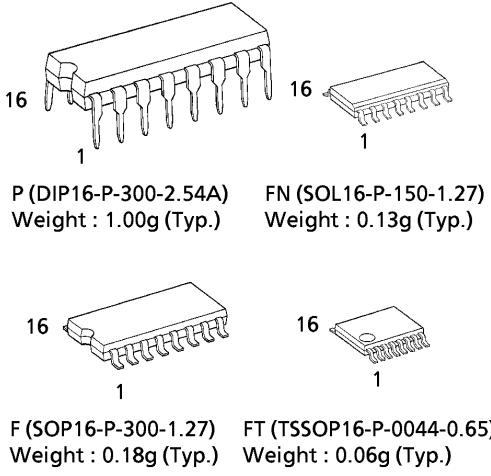
When the enable input is held “H”, all four outputs are fixed at a high logic level independent of the other inputs.

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

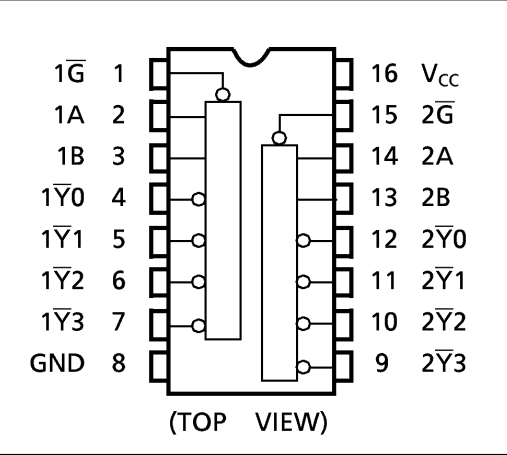
FEATURES :

- High Speed..... $t_{pd} = 5.9\text{ns}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 8\mu\text{A}(\text{Max.})$  at  $T_a = 25^{\circ}\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC} (\text{Min.})$
- Symmetrical Output Impedance... $|I_{OH}| = |I_{OL}| = 24\text{mA}(\text{Min.})$   
Capability of driving 50Ω transmission lines.
- Balanced Propagation Delays..... $t_{PLH} \approx t_{PHL}$
- Wide Operating Voltage Range...  $V_{CC} (\text{opr}) = 2\text{V} \sim 5.5\text{V}$
- Pin and Function Compatible with 74F139

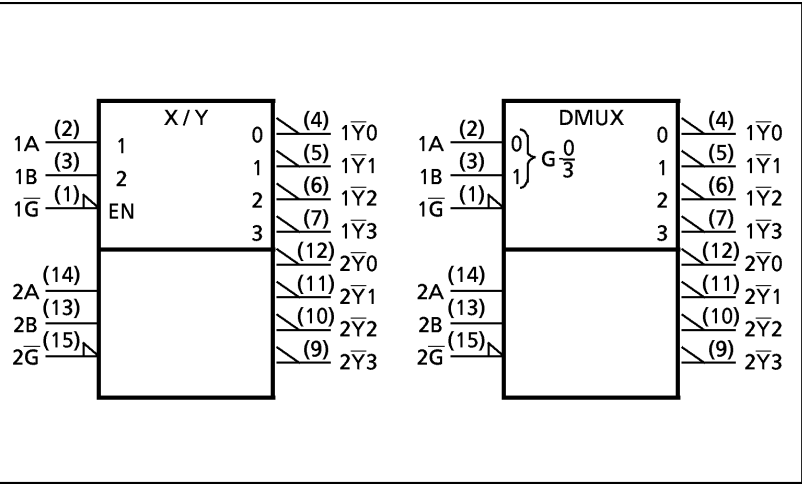
(Note) The JEDEC SOP (FN) is not available in Japan.



PIN ASSIGNMENT



IEC LOGIC SYMBOL

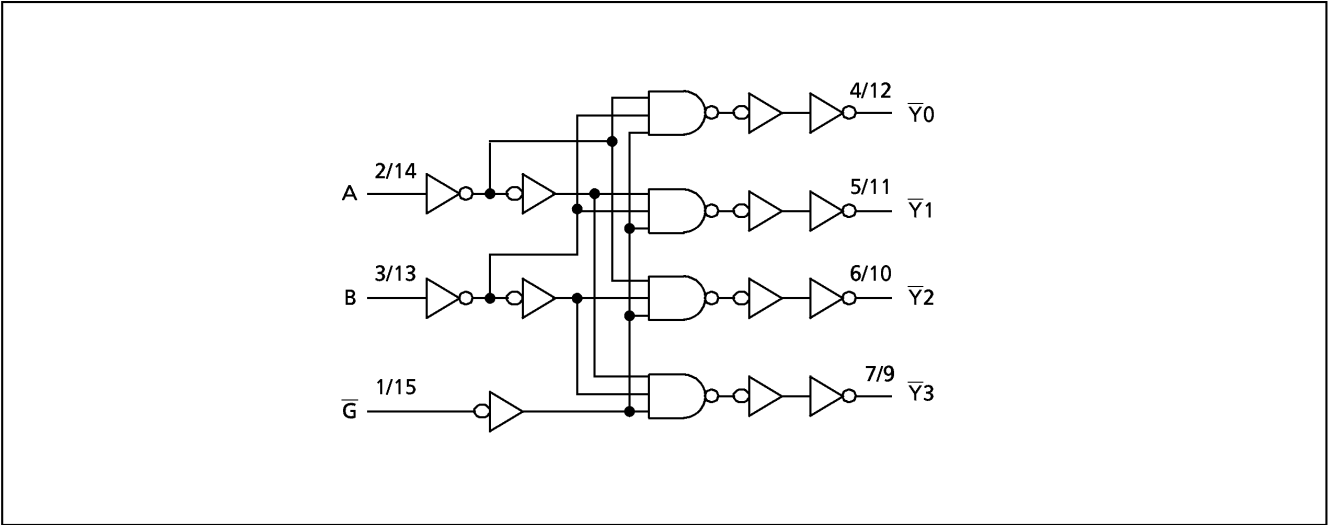


TRUTH TABLE

| INPUTS |        |   | OUTPUTS |    |    |    | SELECTED OUTPUT |
|--------|--------|---|---------|----|----|----|-----------------|
| ENABLE | SELECT |   | Y0      | Y1 | Y2 | Y3 |                 |
| G      | B      | A |         |    |    |    |                 |
| 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

SYSTEM DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| PARAMETER                   | SYMBOL    | VALUE                        | UNIT        |
|-----------------------------|-----------|------------------------------|-------------|
| Supply Voltage Range        | $V_{CC}$  | $-0.5 \sim 7.0$              | 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        | $I_{OK}$  | $\pm 50$                     | mA          |
| DC Output Current           | $I_{OUT}$ | $\pm 50$                     | mA          |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 200$                    | mA          |
| Power Dissipation           | $P_D$     | 500 (DIP)* / 180 (SOP/TSSOP) | mW          |
| Storage Temperature         | $T_{stg}$ | $-65 \sim 150$               | $^{\circ}C$ |

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

RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL    | VALUE                                                                 | UNIT        |
|--------------------------|-----------|-----------------------------------------------------------------------|-------------|
| Supply Voltage           | $V_{CC}$  | 2.0~5.5                                                               | V           |
| Input Voltage            | $V_{IN}$  | 0~ $V_{CC}$                                                           | V           |
| Output Voltage           | $V_{OUT}$ | 0~ $V_{CC}$                                                           | V           |
| Operating Temperature    | $T_{opr}$ | $-40 \sim 85$                                                         | $^{\circ}C$ |
| Input Rise and Fall Time | $dt/dV$   | 0~ 100 ( $V_{CC} = 3.3 \pm 0.3V$ )<br>0~ 20 ( $V_{CC} = 5 \pm 0.5V$ ) | ns / V      |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                   | SYMBOL          | TEST CONDITION                                          |                          | V <sub>CC</sub><br>(V) | Ta = 25°C            |                   |                      | Ta = -40~85°C        |                      | UNIT |
|-----------------------------|-----------------|---------------------------------------------------------|--------------------------|------------------------|----------------------|-------------------|----------------------|----------------------|----------------------|------|
|                             |                 |                                                         |                          |                        | MIN.                 | TYP.              | MAX.                 | MIN.                 | MAX.                 |      |
| High - Level Input Voltage  | V <sub>IH</sub> |                                                         |                          | 2.0<br>3.0<br>5.5      | 1.50<br>2.10<br>3.85 | —<br>—<br>—       | —<br>—<br>—          | 1.50<br>2.10<br>3.85 | —<br>—<br>—          | V    |
| Low - Level Input Voltage   | V <sub>IL</sub> |                                                         |                          | 2.0<br>3.0<br>5.5      | —<br>—<br>—          | —<br>—<br>—       | 0.50<br>0.90<br>1.65 | —<br>—<br>—          | 0.50<br>0.90<br>1.65 | V    |
| High - Level Output Voltage | V <sub>OH</sub> | V <sub>IN</sub> =<br>V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = -50μA  | 2.0<br>3.0<br>4.5      | 1.9<br>2.9<br>4.4    | 2.0<br>3.0<br>4.5 | —<br>—<br>—          | 1.9<br>2.9<br>4.4    | —<br>—<br>—          | V    |
|                             |                 |                                                         | I <sub>OH</sub> = -4mA   | 3.0                    | 2.58                 | —                 | —                    | 2.48                 | —                    |      |
|                             |                 |                                                         | I <sub>OH</sub> = -24mA  | 4.5                    | 3.94                 | —                 | —                    | 3.80                 | —                    |      |
|                             |                 |                                                         | I <sub>OH</sub> = -75mA* | 5.5                    | —                    | —                 | —                    | 3.85                 | —                    |      |
| Low - Level Output Voltage  | V <sub>OL</sub> | V <sub>IN</sub> =<br>V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OL</sub> = 50μA   | 2.0<br>3.0<br>4.5      | —<br>—<br>—          | 0.0<br>0.0<br>0.0 | 0.1<br>0.1<br>0.1    | —<br>—<br>—          | 0.1<br>0.1<br>0.1    | V    |
|                             |                 |                                                         | I <sub>OL</sub> = 12mA   | 3.0                    | —                    | —                 | 0.36                 | —                    | 0.44                 |      |
|                             |                 |                                                         | I <sub>OL</sub> = 24mA   | 4.5                    | —                    | —                 | 0.36                 | —                    | 0.44                 |      |
|                             |                 |                                                         | I <sub>OL</sub> = 75mA*  | 5.5                    | —                    | —                 | —                    | —                    | 1.65                 |      |
| Input Leakage Current       | I <sub>IN</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                |                          | 5.5                    | —                    | —                 | ±0.1                 | —                    | ±1.0                 | μA   |
| Quiescent Supply Current    | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                |                          | 5.5                    | —                    | —                 | 8.0                  | —                    | 80.0                 |      |

\* : This spec indicates the capability of driving 50Ω transmission lines.

One output should be tested at a time for a 10ms maximum duration.

AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω, Input t<sub>r</sub> = t<sub>f</sub> = 3ns)

| PARAMETER                                           | SYMBOL                               | TEST CONDITION |                     | Ta = 25°C |      |      | Ta = − 40~85°C |      | UNIT |
|-----------------------------------------------------|--------------------------------------|----------------|---------------------|-----------|------|------|----------------|------|------|
|                                                     |                                      |                | V <sub>CC</sub> (V) | MIN.      | TYP. | MAX. | MIN.           | MAX. |      |
| Propagation Delay Time<br>(A, B − $\bar{Y}$ )       | t <sub>pLH</sub><br>t <sub>pHL</sub> |                | 3.3 ± 0.3           | —         | 8.2  | 13.9 | 1.0            | 16.0 | ns   |
|                                                     |                                      |                | 5.0 ± 0.5           | —         | 6.2  | 9.0  | 1.0            | 10.3 |      |
| Propagation Delay Time<br>( $\bar{G}$ − $\bar{Y}$ ) | t <sub>pLH</sub><br>t <sub>pHL</sub> |                | 3.3 ± 0.3           | —         | 7.6  | 12.9 | 1.0            | 14.8 |      |
|                                                     |                                      |                | 5.0 ± 0.5           | —         | 5.8  | 8.5  | 1.0            | 9.6  |      |
| Input Capacitance                                   | C <sub>IN</sub>                      |                |                     | —         | 5    | 10   | —              | 10   | pF   |
| Power Dissipation Capacitance                       | C <sub>PD</sub> (1)                  |                |                     | —         | 110  | —    | —              | —    |      |

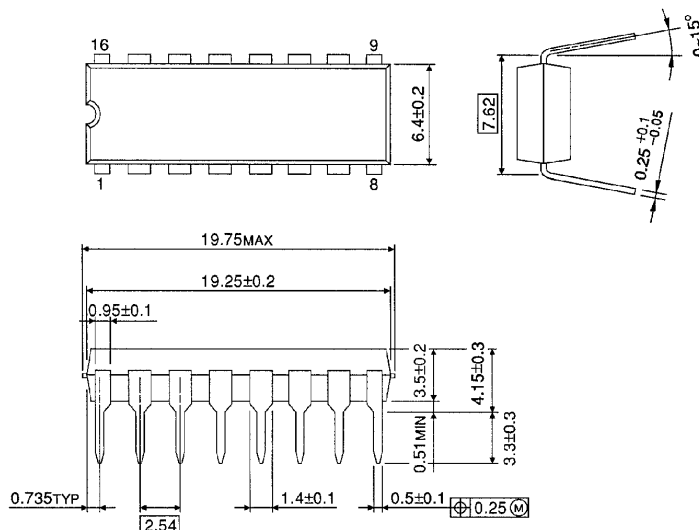
Note (1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

## DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A)

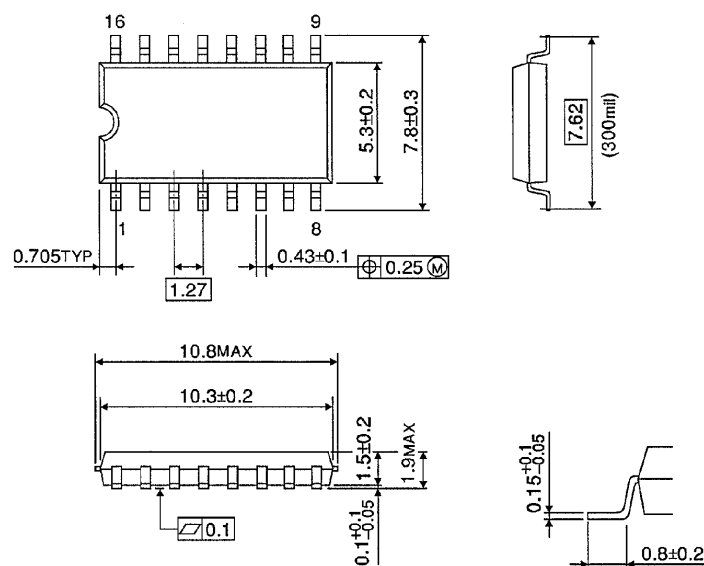
Unit in mm



Weight : 1.00g (Typ.)

## SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27)

Unit in mm

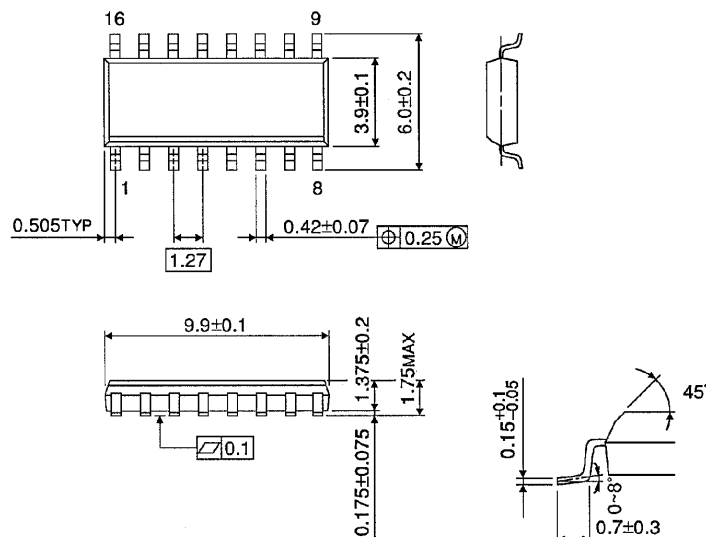


Weight : 0.18g (Typ.)

## SOP 16PIN (150mil BODY) PACKAGE DIMENSIONS (SOL16-P-150 -1.27)

Unit in mm

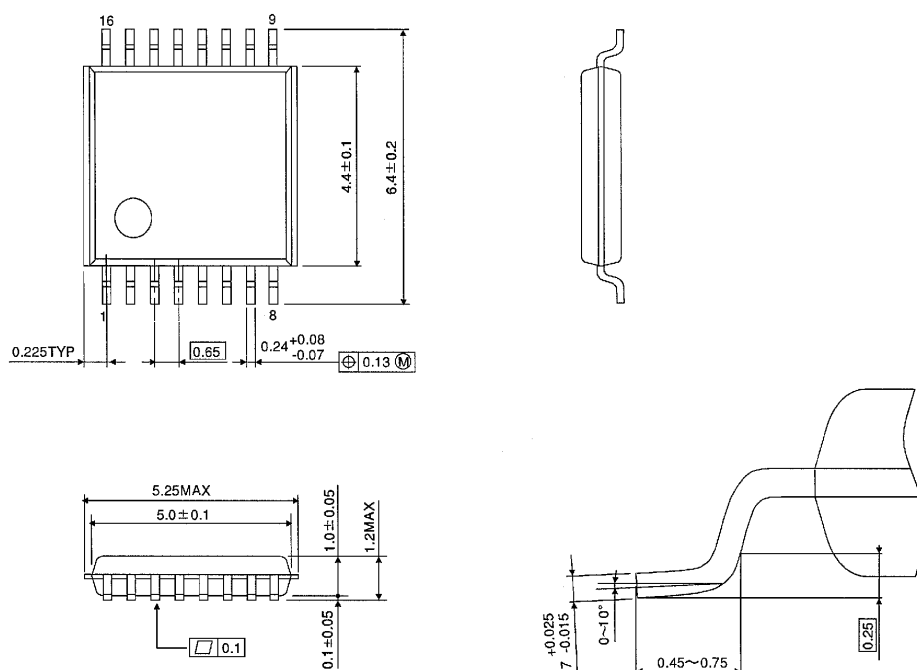
(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

## TSSOP 16PIN PACKAGE DIMENSIONS (TSSOP16-P-0044-0.65)

Unit in mm



Weight : 0.06g (Typ.)

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000707EBA

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