

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74HC148AP, TC74HC148AF

8-TO-3 LINE PRIORITY ENCODER

The TC74HC148A is a high speed CMOS 8-to-3 LINE ENCODER fabricated with silicon gate C²MOS technology.

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

All data inputs and outputs of these encoders are active at the low logic level.

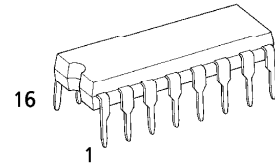
The encoder detects a low level of the highest order among eight input signals and outputs the corresponding signal position in binary code.

Enable Input EI and Enable Output EO are used to easily cascade without using external circuits.

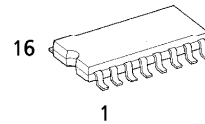
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES :

- High Speed..... $t_{pd} = 15\text{ns}(\text{typ.})$ 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 74LS148

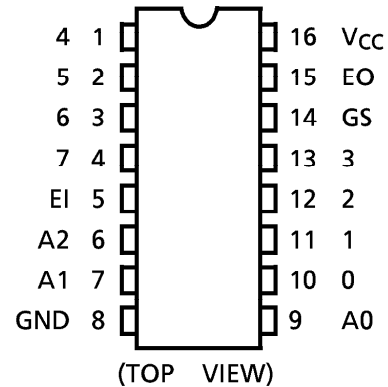


P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)

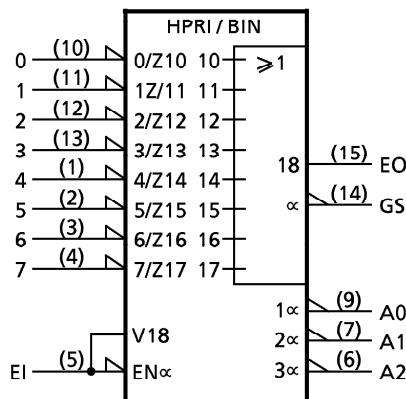


F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)

PIN ASSIGNMENT



IEC LOGIC SYMBOL



961001EBA2

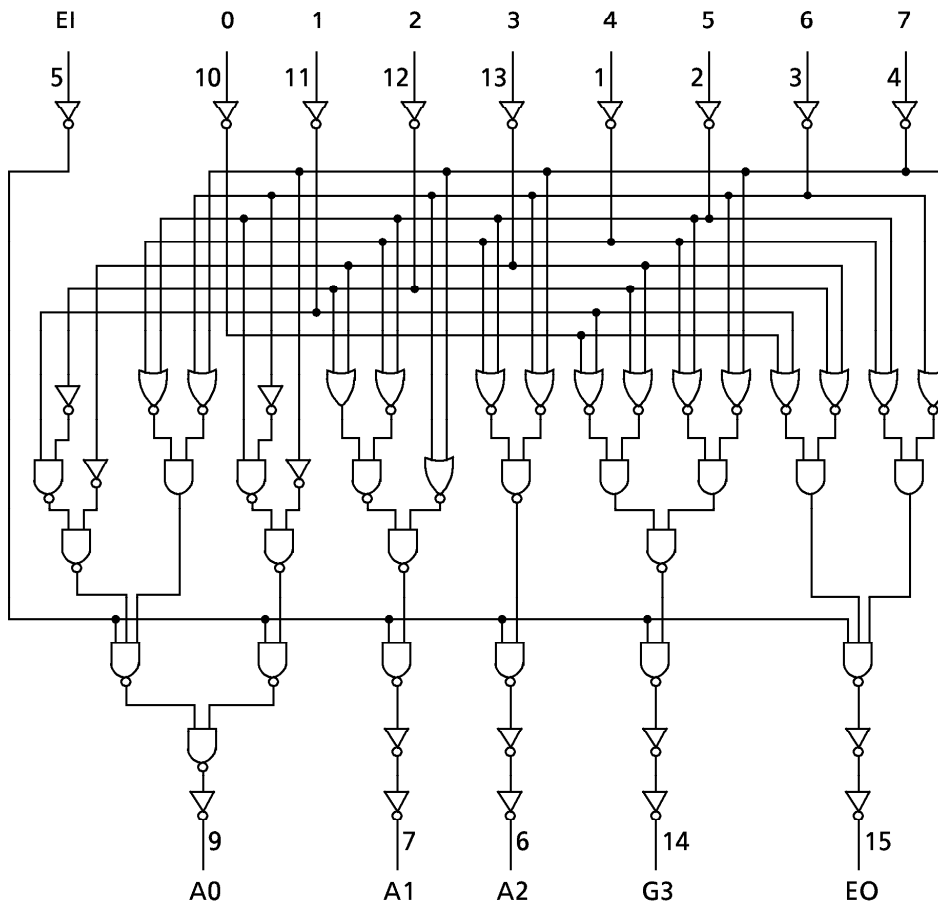
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TRUTH TABLE

| EI | INPUTS | | | | | | | | OUTPUTS | | | | |
|----|--------|---|---|---|---|---|---|---|---------|----|----|----|----|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A2 | A1 | A0 | GS | EO |
| H | X | X | X | X | X | X | X | X | H | H | H | H | H |
| L | H | H | H | H | H | H | H | H | H | H | H | H | L |
| L | X | X | X | X | X | X | X | L | L | L | L | L | H |
| L | X | X | X | X | X | X | L | H | L | L | H | L | H |
| L | X | X | X | X | L | H | H | H | L | H | L | L | H |
| L | X | X | X | L | H | H | H | H | H | L | L | L | H |
| L | X | X | L | H | H | H | H | H | H | L | H | L | H |
| L | X | L | H | H | H | H | H | H | H | H | L | L | H |
| L | L | H | H | H | H | H | H | H | H | H | H | L | H |

X : Don't care

SYSTEM DIAGRAM



961001EBA2'

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- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
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ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | VALUE | UNIT |
|------------------------------|-----------|------------------------|------|
| Supply Voltage Range | V_{CC} | -0.5~7 | V |
| DC Input Voltage | V_{IN} | -0.5~ $V_{CC} + 0.5$ | V |
| DC Output Voltage | V_{OUT} | -0.5~ $V_{CC} + 0.5$ | V |
| Input Diode Current | I_{IK} | ± 20 | mA |
| Output Diode Current | I_{OK} | ± 20 | mA |
| DC Output Current | I_{OUT} | ± 25 | mA |
| DC V_{CC} / Ground Current | I_{CC} | ± 50 | mA |
| Power Dissipation | P_D | 500 (DIP)* / 180 (SOP) | mW |
| Storage Temperature | T_{stg} | -65~150 | °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°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} | 2~6 | V |
| Input Voltage | V_{IN} | 0~ V_{CC} | V |
| Output Voltage | V_{OUT} | 0~ V_{CC} | V |
| Operating Temperature | T_{opr} | -40~85 | °C |
| Input Rise and Fall Time | t_r, t_f | 0~1000 ($V_{CC} = 2.0\text{V}$) 0~500 ($V_{CC} = 4.5\text{V}$) 0~400 ($V_{CC} = 6.0\text{V}$) | ns |

DC ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITION | V_{CC} (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 | 1.50 | — | — | 1.50 | — | V | |
| | | | 4.5 | 3.15 | — | — | 3.15 | — | | |
| | | | 6.0 | 4.20 | — | — | 4.20 | — | | |
| Low - Level Input Voltage | V_{IL} | | 2.0 | — | — | 0.50 | — | 0.50 | V | |
| | | | 4.5 | — | — | 1.35 | — | 1.35 | | |
| | | | 6.0 | — | — | 1.80 | — | 1.80 | | |
| High - Level Output Voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -20\mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | | |
| | | | $I_{OH} = -4\text{ mA}$ $I_{OH} = -5.2\text{ mA}$ | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| | | | | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| | | | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V | |
| 4.5 | — | 0.0 | 0.1 | — | 0.1 | | | | | |
| 6.0 | — | 0.0 | 0.1 | — | 0.1 | | | | | |
| Low - Level Output Voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 20\mu\text{A}$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | | |
| | | | $I_{OL} = 4\text{ mA}$ $I_{OL} = 5.2\text{ mA}$ | 4.5 | — | 0.17 | 0.26 | — | 0.33 | |
| | | | | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| Input Leakage Current | I_{IN} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | ± 0.1 | — | ± 1.0 | μA | |
| Quiescent Supply Current | I_{CC} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | 4.0 | — | 40.0 | | |

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} t_{THL} | | — | 4 | 8 | ns |
| Propagation Delay Time (IN—A0, A1, A2) | t_{PLH} t_{PHL} | | — | 15 | 25 | |
| Propagation Delay Time (IN—EO, GS) | t_{PLH} t_{PHL} | | — | 15 | 25 | |
| Propagation Delay Time (EI—EO) | t_{PLH} t_{PHL} | | — | 11 | 19 | |
| Propagation Delay Time (EI—GS) | t_{PLH} t_{PHL} | | — | 11 | 19 | |
| Propagation Delay Time (EI—A0, A1, A2) | t_{PLH} t_{PHL} | | — | 11 | 19 | |

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

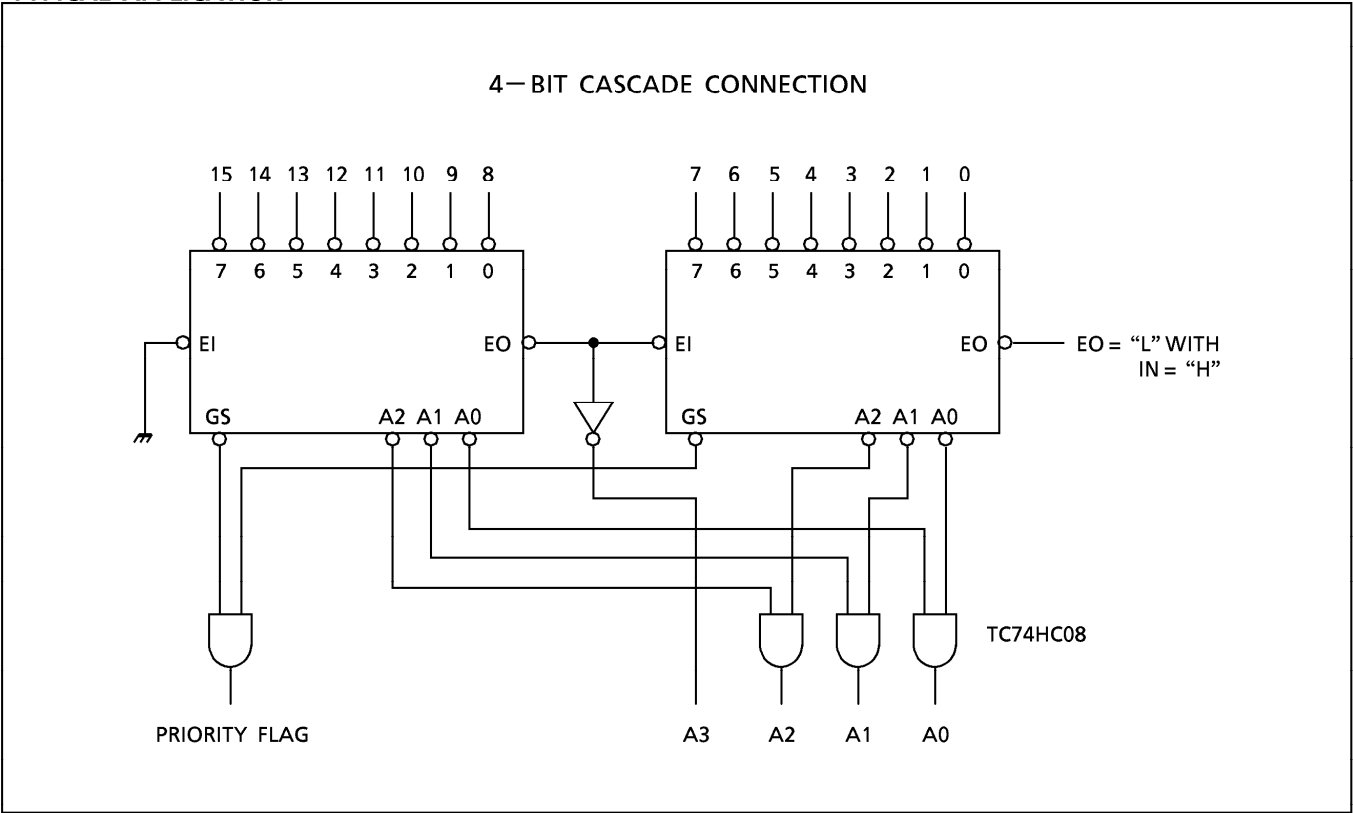
| PARAMETER | SYMBOL | TEST CONDITION | $T_a = 25^\circ\text{C}$ | | | $T_a = -40\sim 85^\circ\text{C}$ | | UNIT |
|---|------------------------|----------------|--------------------------|------|------|----------------------------------|------|------|
| | | | $V_{CC}(\text{V})$ | MIN. | TYP. | MAX. | MIN. | |
| Output Transition Time | t_{TLH} t_{THL} | | 2.0 | — | 30 | 75 | — | 95 |
| | | | 4.5 | — | 8 | 15 | — | 19 |
| | | | 6.0 | — | 7 | 13 | — | 16 |
| Propagation Delay Time (IN—A0, A1, A2) | t_{PLH} t_{PHL} | | 2.0 | — | 52 | 150 | — | 190 |
| | | | 4.5 | — | 19 | 30 | — | 38 |
| | | | 6.0 | — | 15 | 26 | — | 33 |
| Propagation Delay Time (IN—EO, GS) | t_{PLH} t_{PHL} | | 2.0 | — | 52 | 150 | — | 190 |
| | | | 4.5 | — | 19 | 30 | — | 38 |
| | | | 6.0 | — | 15 | 26 | — | 33 |
| Propagation Delay Time (EI—EO) | t_{PLH} t_{PHL} | | 2.0 | — | 40 | 115 | — | 145 |
| | | | 4.5 | — | 14 | 23 | — | 29 |
| | | | 6.0 | — | 11 | 20 | — | 25 |
| Propagation Delay Time (EI—GS) | t_{PLH} t_{PHL} | | 2.0 | — | 40 | 115 | — | 145 |
| | | | 4.5 | — | 14 | 23 | — | 29 |
| | | | 6.0 | — | 12 | 20 | — | 25 |
| Propagation Delay Time (EI—A0, A1, A2) | t_{PLH} t_{PHL} | | 2.0 | — | 40 | 115 | — | 145 |
| | | | 4.5 | — | 14 | 23 | — | 29 |
| | | | 6.0 | — | 12 | 20 | — | 25 |
| Input Capacitance | C_{IN} | | — | 5 | 10 | — | 10 | pF |
| Power Dissipation Capacitance | $C_{PD}(1)$ | | — | 55 | — | — | — | |

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 :

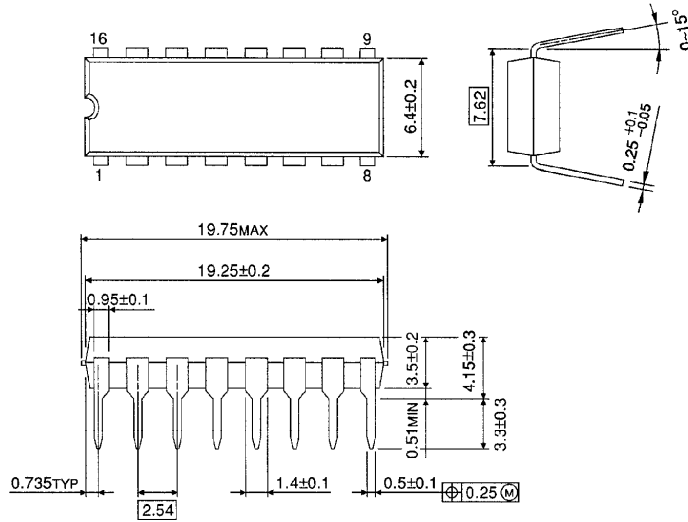
$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

TYPICAL APPLICATION



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

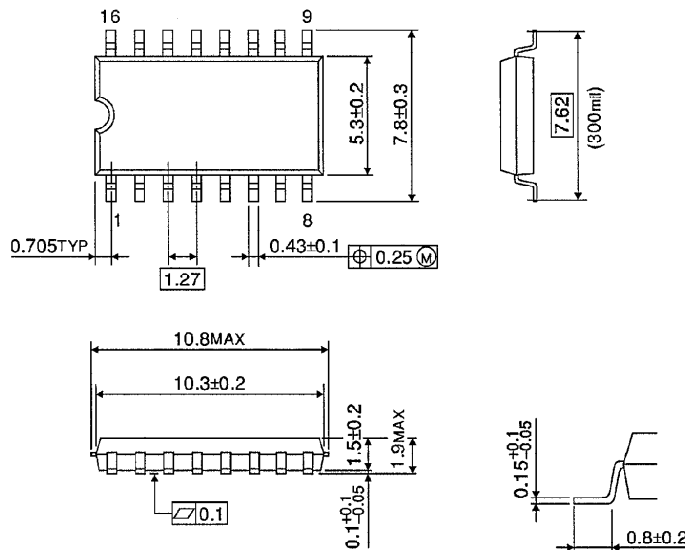
Unit in mm



Weight : 1.00g (Typ.)

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

Unit in mm



Weight : 0.18g (Typ.)