

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.

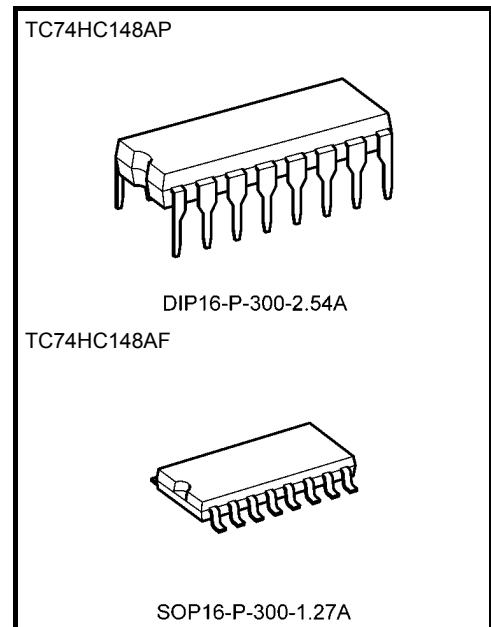
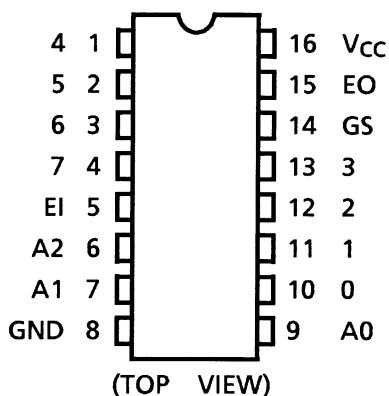
Enable Input EI and Enable Output EO are used to easily cascade without using external circuits.

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

Features

- High speed: $t_{pd} = 15 \text{ ns}$ (typ.) at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 4 \text{ mA}$ (min)
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} \text{ (opr)} = 2 \text{ to } 6 \text{ V}$
- Pin and function compatible with 74LS148

Pin Assignment

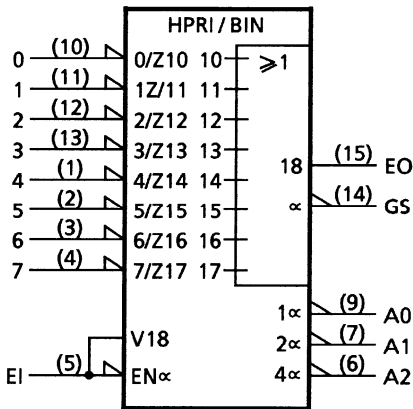


Weight

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

SOP16-P-300-1.27A : 0.18 g (typ.)

IEC Logic Symbol

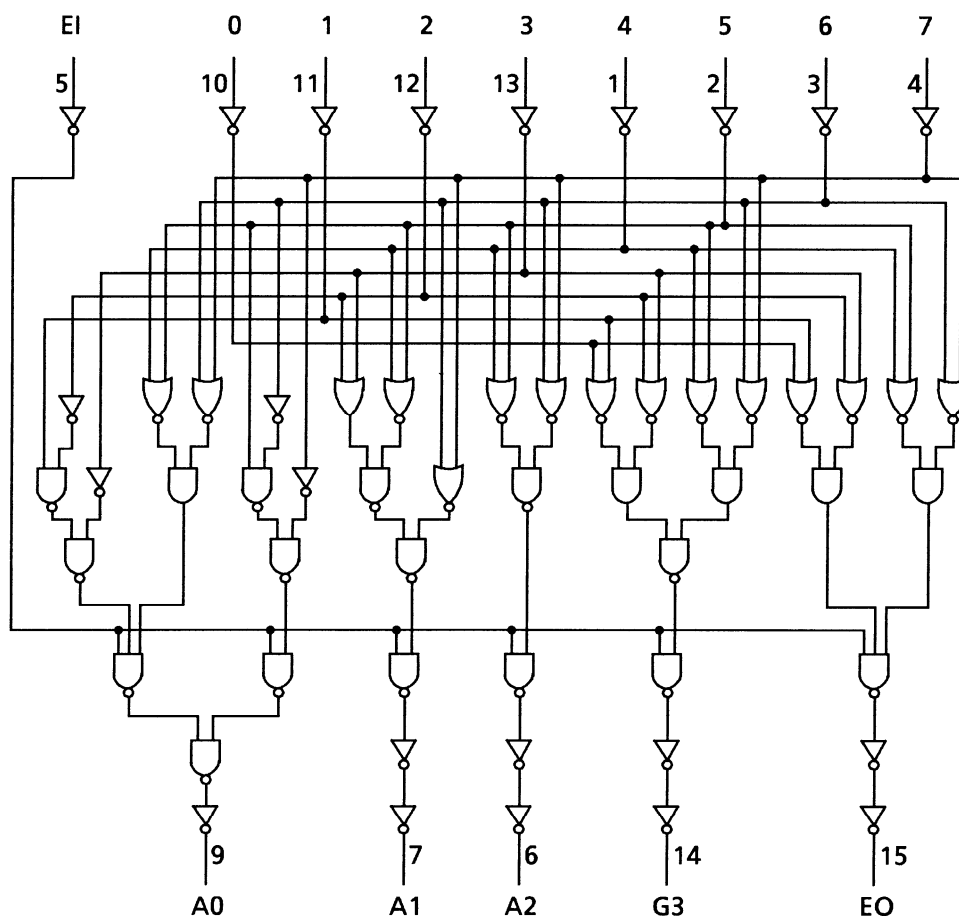


Truth Table

Inputs									Outputs				
E1	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	X	L	H	H	L	H	L	L	H
L	X	X	X	L	H	H	H	H	L	H	H	L	H
L	X	X	L	H	H	H	H	H	H	L	L	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



Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7	V
DC input voltage	V_{IN}	-0.5 to $V_{CC} + 0.5$	V
DC output voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	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) (Note 2)/180 (SOP)	mW
Storage temperature	T_{stg}	-65 to 150	°C

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: 500 mW in the range of $T_a = -40$ to 65°C . From $T_a = 65$ to 85°C a derating factor of $-10\text{ mW}/^\circ\text{C}$ shall be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 6	V
Input voltage	V_{IN}	0 to V_{CC}	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	t_r, t_f	0 to 1000 ($V_{CC} = 2.0$ V) 0 to 500 ($V_{CC} = 4.5$ V) 0 to 400 ($V_{CC} = 6.0$ V)	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

Electrical Characteristics
DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				VCC (V)	Min	Typ.	Max	Min		Max
High-level input voltage	VIH	—		2.0 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	V	
Low-level input voltage	VIL	—		2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	0.50 1.35 1.80	
High-level output voltage	VOH	VIN = VIH or VIL	IOH = -20 μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
			IOH = -4 mA IOH = -5.2 mA	6.0	5.9	6.0	—	5.9	—	
				4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	— —	
Low-level output voltage	VOL	VIN = VIH or VIL	IOL = 20 μA	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
			IOL = 4 mA IOL = 5.2 mA	6.0	—	0.0	0.1	—	0.1	
				4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33	
Input leakage current	IIN	VIN = VCC or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	ICC	VIN = VCC or GND		6.0	—	—	4.0	—	40.0	μA

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

Characteristics	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	ns
Propagation delay time (IN-E0, GS)	t_{pLH} t_{pHL}	—	—	15	25	ns
Propagation delay time (EI-E0)	t_{pLH} t_{pHL}	—	—	11	19	ns
Propagation delay time (EI-GS)	t_{pLH} t_{pHL}	—	—	11	19	ns
Propagation delay time (EI-A0, A1, A2)	t_{pLH} t_{pHL}	—	—	11	19	ns

AC Characteristics ($C_L = 50 \text{ pF}$, input: $t_r = t_f = 6 \text{ ns}$)

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max
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-E0, GS)	t_{pLH} t_{pHL}	—	2.0	—	52	150	—	190
			4.5	—	19	30	—	38
			6.0	—	15	26	—	33
Propagation delay time (EI-E0)	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
Power dissipation capacitance	C_{PD} (Note)	—	—	—	55	—	—	—

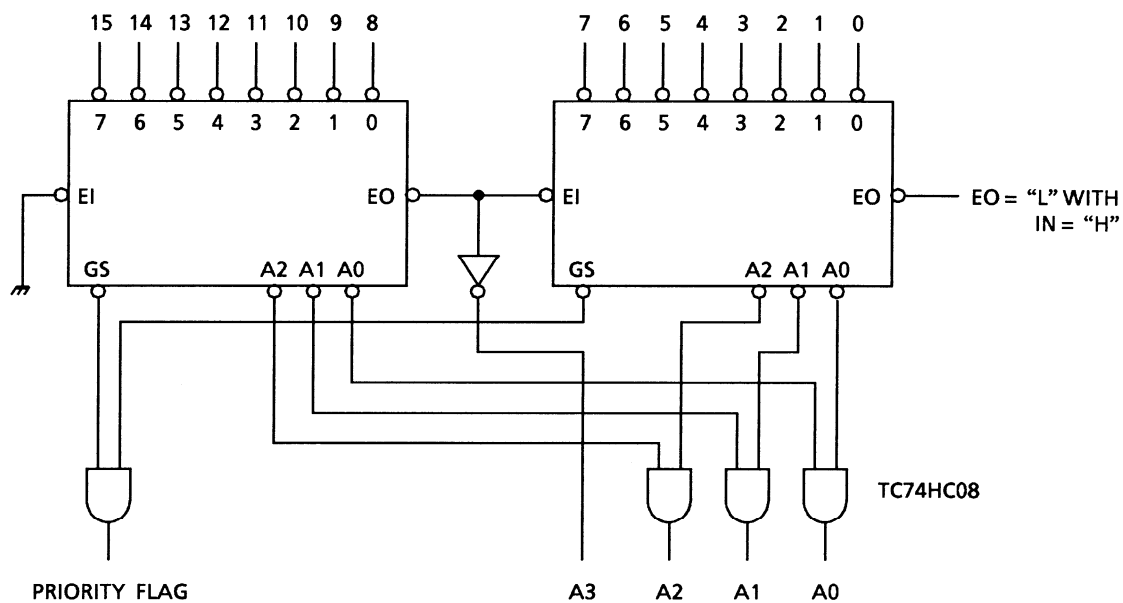
Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

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

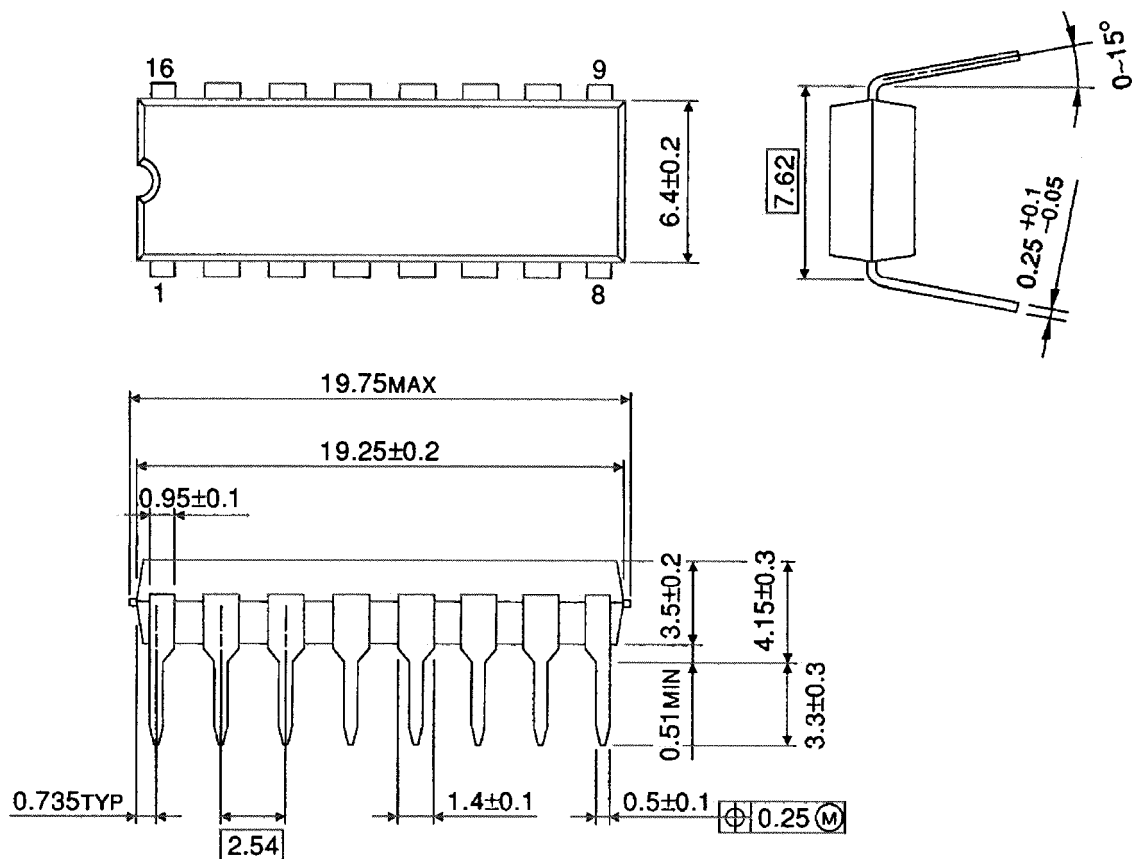
4-BIT CASCADE CONNECTION



Package Dimensions

DIP16-P-300-2.54A

Unit : mm

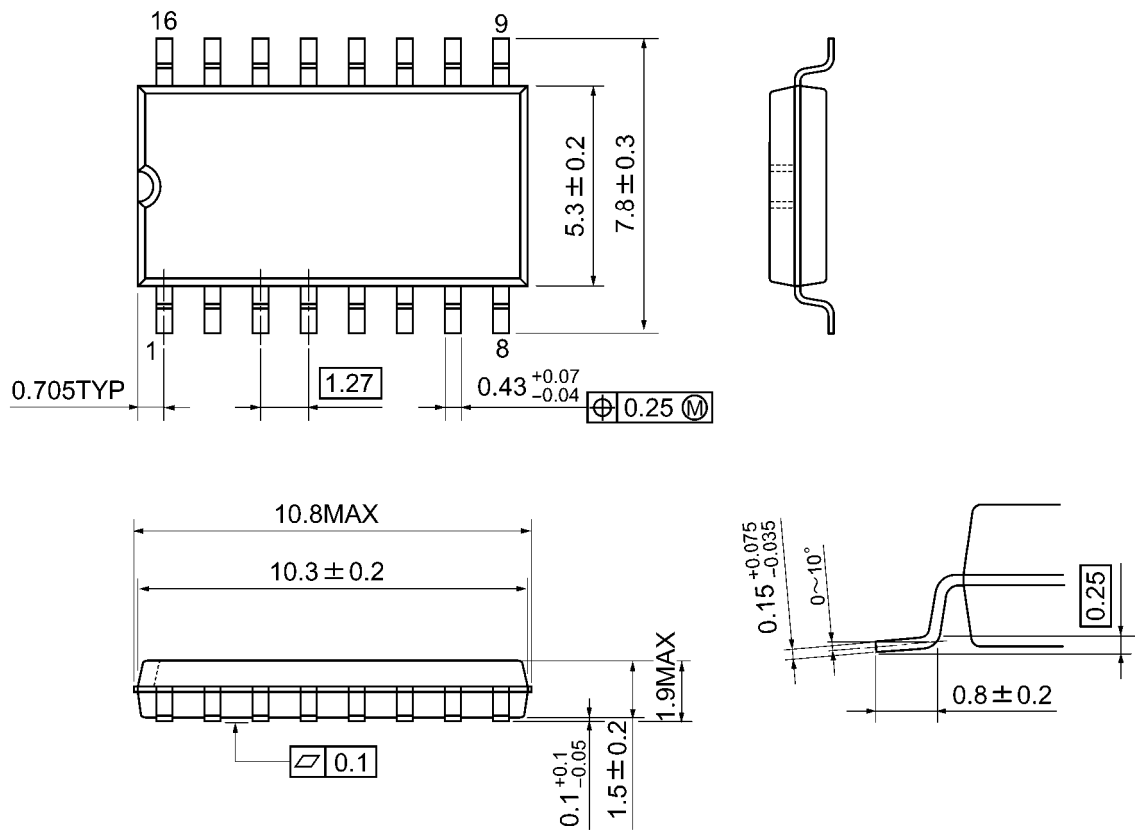


Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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