

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74HC7240AP, TC74HC7240AF TC74HC7244AP, TC74HC7244AF

Octal Bus Buffer (with schmitt trigger inputs)

TC74HC7240AP/AF Inverted, 3-State Outputs

TC74HC7244AP/AF Non-Inverted, 3-State Outputs

The TC74HC7240A/7244A are high speed CMOS OCTAL BUS BUFFERS with silicon gate C<sup>2</sup>MOS technology.

They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

The TC74HC7240A/7244A have same pin configuration and function as the TC74HC240A/244A. And they have a hysteresis characteristics with each input, so TC74HC7240A/7244A can be used as a line receiver, etc.

They have two active low output enables.

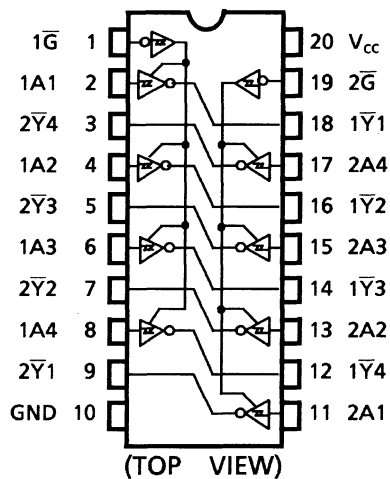
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### Features

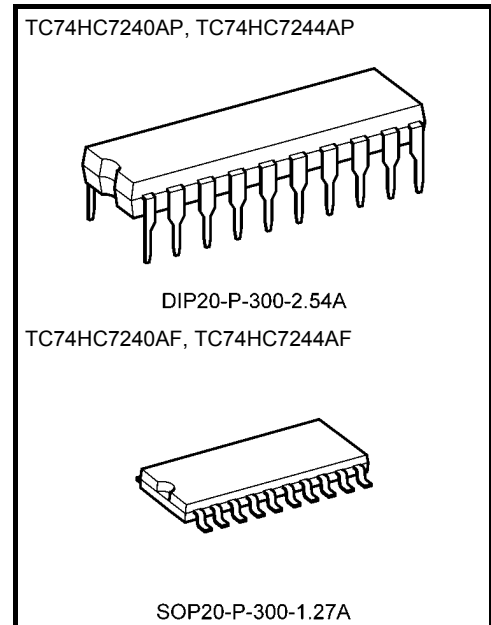
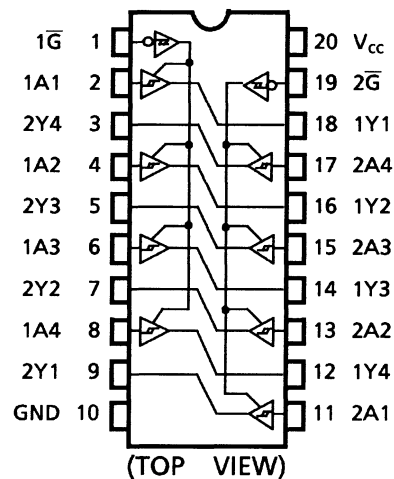
- High speed:  $t_{pd} = 15 \text{ ns}$  (typ.) at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 4 \mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_H = 1.1 \text{ V}$  (typ.) at  $V_{CC} = 5 \text{ V}$
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 6 \text{ mA}$  (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 74LS240/244

### Pin Assignment

TC74HC7240A



TC74HC7244A



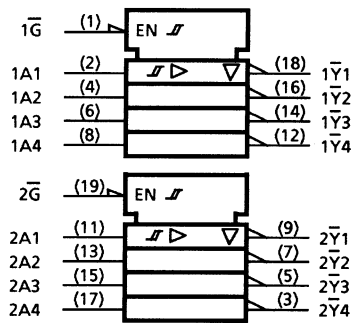
Weight

DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)

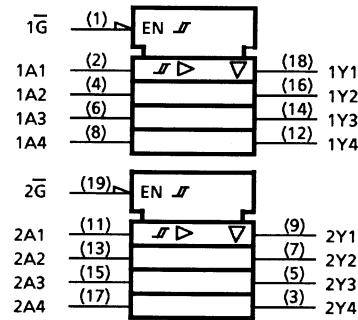
Start of commercial production  
1988-11

## IEC Logic Symbol

### TC74HC7240A



### TC74HC7244A



## Truth Table

Inputs		Outputs	
$\bar{G}$	$A_n$	$Y_n$	$\bar{Y}_n^\Delta$
L	L	L	H
L	H	H	L
H	X	Z	Z

$\Delta$ : For TC74HC7240A only

X: Don't care

Z: High impedance

## 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	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
DC output current	$I_{OUT}$	$\pm 35$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 75$	mA
Power dissipation	$P_D$	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}C$

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  $65^{\circ}C$ . From  $T_a = 65$  to  $85^{\circ}C$  a derating factor of  $-10$  mW/ $^{\circ}C$  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

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	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit		
			$V_{CC}$ (V)	Min	Typ.	Max	Min		Max	
Positive threshold voltage	$V_P$	—	2.0	1.0	1.25	1.5	1.0	1.5	V	
			4.5	2.3	2.7	3.15	2.3	3.15		
			6.0	3.0	3.5	4.2	3.0	4.2		
Negative threshold voltage	$V_N$	—	2.0	0.3	0.65	0.9	0.3	0.9	V	
			4.5	1.13	1.6	2.0	1.13	2.0		
			6.0	1.5	2.3	2.6	1.5	2.6		
Hysteresis voltage	$V_H$	—	2.0	0.3	0.6	1.0	0.3	1.0	V	
			4.5	0.6	1.1	1.4	0.6	1.4		
			6.0	0.8	1.2	1.7	0.8	1.7		
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20 \mu\text{A}$	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
			$I_{OH} = -6 \text{ mA}$ $I_{OH} = -7.8 \text{ mA}$	4.5	4.18	4.31	—	4.13	—	
				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	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
			$I_{OL} = 6 \text{ mA}$ $I_{OL} = 7.8 \text{ mA}$	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
3-state output off-state current	$I_{OZ}$	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = V_{CC} \text{ or } \text{GND}$	6.0	—	—	$\pm 0.5$	—	$\pm 5.0$	$\mu\text{A}$	
Input leakage current	$I_{IN}$	$V_{IN} = V_{CC} \text{ or } \text{GND}$	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC} \text{ or } \text{GND}$	6.0	—	—	4.0	—	40.0	$\mu\text{A}$	

## AC Characteristics (input: $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
		CL (pF)	V <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max		
Output transition time	$t_{TLH}$ $t_{THL}$	—	50	2.0	—	25	60	—	75	ns
				4.5	—	7	12	—	15	
				6.0	—	6	10	—	13	
Propagation delay time	$t_{pLH}$ $t_{pHL}$	—	50	2.0	—	50	125	—	155	ns
				4.5	—	15	25	—	31	
				6.0	—	13	21	—	26	
			150	2.0	—	67	165	—	205	
				4.5	—	20	33	—	41	
				6.0	—	17	28	—	35	
Output enable time	$t_{pZL}$ $t_{pZH}$	$R_L = 1 \text{ k}\Omega$	50	2.0	—	68	150	—	190	ns
				4.5	—	21	30	—	38	
				6.0	—	16	26	—	32	
			150	2.0	—	84	165	—	230	
				4.5	—	26	37	—	46	
				6.0	—	20	31	—	39	
Output disable time	$t_{pLZ}$ $t_{pHZ}$	$R_L = 1 \text{ k}\Omega$	50	2.0	—	48	150	—	190	ns
				4.5	—	21	30	—	38	
				6.0	—	19	26	—	32	
Input capacitance	C <sub>IN</sub>	—	—	—	5	10	—	10	pF	
Output capacitance	C <sub>OUT</sub>	—	—	—	10	—	—	—	pF	
Power dissipation capacitance	C <sub>PD</sub> (Note)	TC74HC7240A		—	33	—	—	—	pF	
		TC74HC7244A		—	34	—	—	—		

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

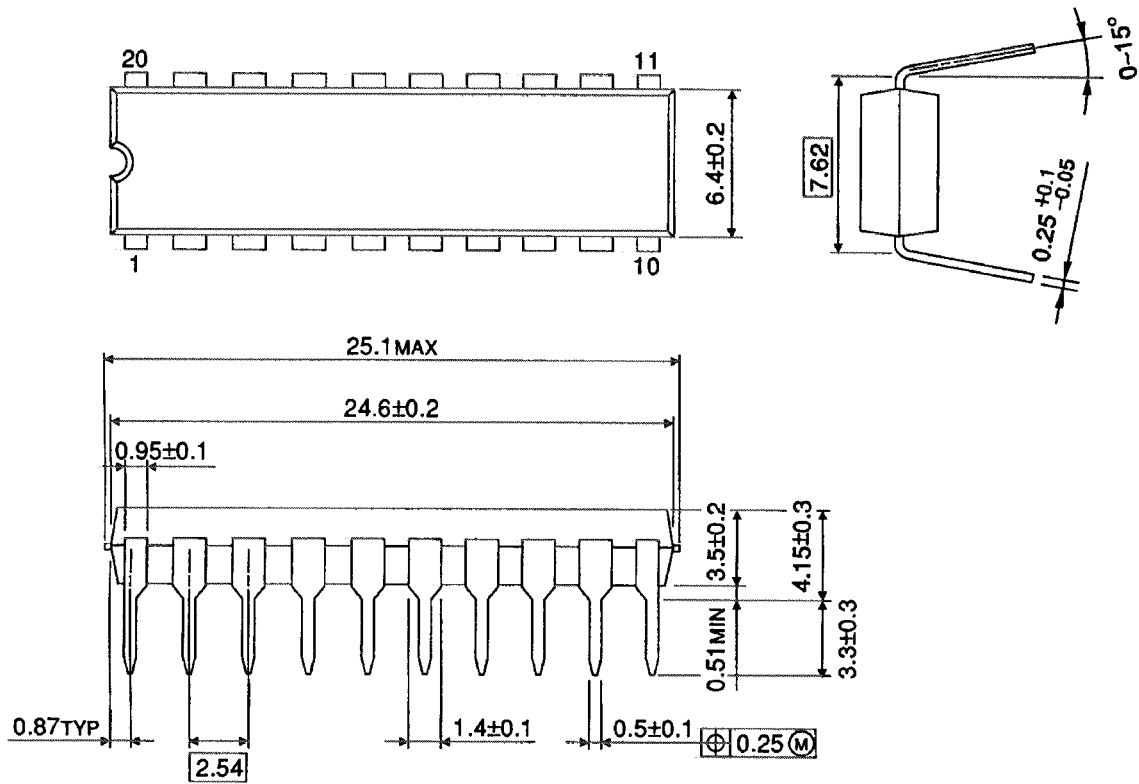
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

## Package Dimensions

DIP20-P-300-2.54A

Unit : mm

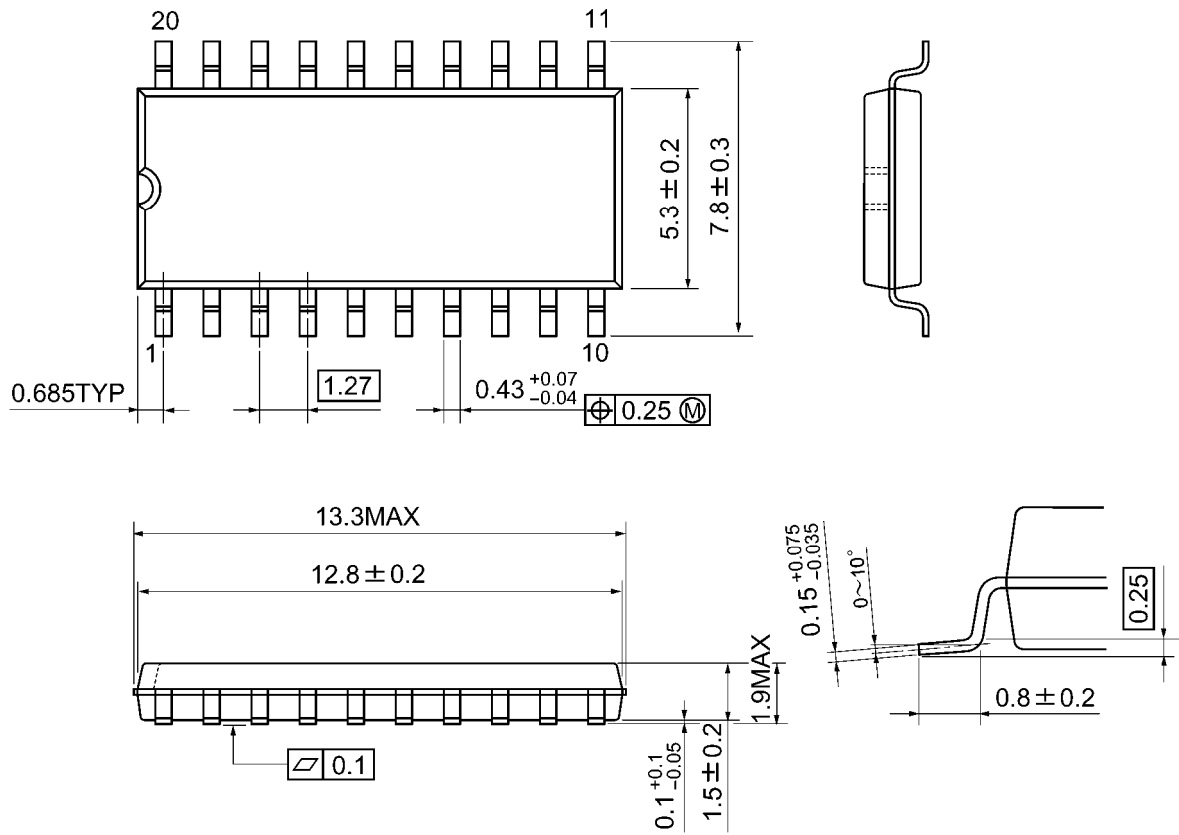


Weight: 1.30 g (typ.)

**Package Dimensions**

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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