

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HC240AP,TC74HC240AF,TC74HC241AP TC74HC241AF,TC74HC244AP,TC74HC244AF

Octal Bus Buffer

TC74HC240AP/AF	Inverted, 3-State Outputs
TC74HC241AP/AF	Non-Inverted, 3-State Outputs
TC74HC244AP/AF	Non-Inverted, 3-State Outputs

The TC74HC240A, 241A and 244A are high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate CMOS technology.

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

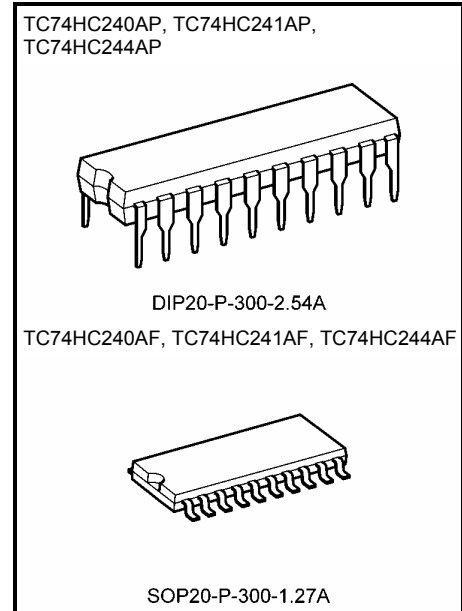
The 74HC240A is an inverting 3-state buffer having two active-low output enables. The TC74HC241A and TC74HC244A are non-inverting 3-state buffers that differ only in that the 241A has one active-high and one active-low output enable, and the 244A has two active-low output enables.

These devices are designed to be used with 3-state memory address drivers, etc.

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

Features

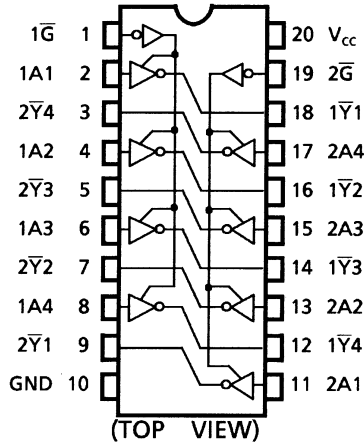
- High speed: $t_{pd} = 10 \text{ ns}$ (typ.) at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 6 \text{ mA}$ (min)
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} \text{ (opr)} = 2\sim 6 \text{ V}$
- Pin and function compatible with 74LS240/241/244



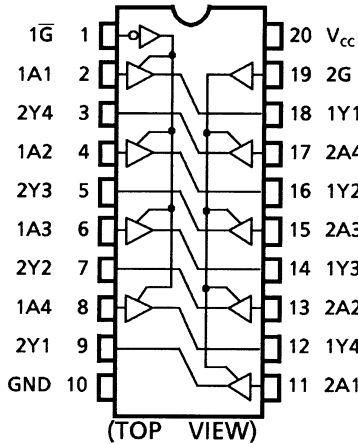
Weight	
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)

Pin Assignment

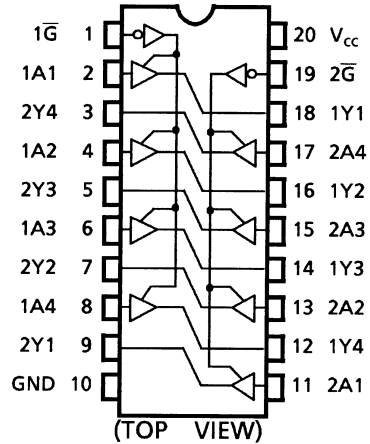
TC74HC240A



TC74HC241A

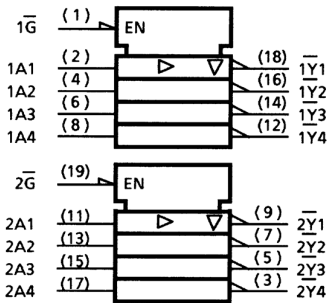


TC74HC244A

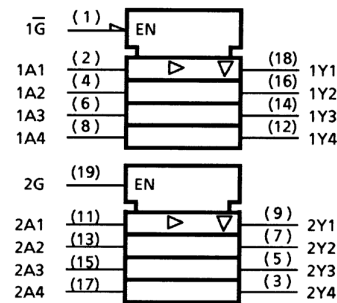


IEC Logic Symbol

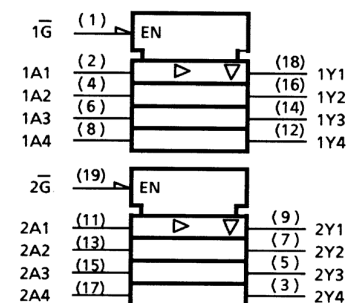
TC74HC240A



TC74HC241A



TC74HC244A



Truth Table

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

Δ : For TC74HC241A only

$\Delta\Delta$: For TC74HC240A only

X: Don't care

Z: High impedance

Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	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}	± 35	mA
DC V_{CC} /ground current	I_{CC}	± 75	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	T_{stg}	-65~150	°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}	2~6	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

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

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit		
				V _{CC} (V)	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 μA	2.0	1.9	2.0	—	1.9	—	V
					4.5	4.4	4.5	—	4.4	—	
				I _{OH} = -6 mA I _{OH} = -7.8 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} or V _{IL}		I _{OL} = 20 μA	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} = 6 mA I _{OL} = 7.8 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} or V _{IL} V _{OUT} = V _{CC} or GND		6.0	—	—	±0.5	—	±5.0	μA	
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	μA	

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

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit	
		CL (pF)	VCC (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	—	36	90	—	115	ns
				4.5	—	12	18	—	23	
				6.0	—	10	15	—	20	
			150	2.0	—	51	130	—	165	
				4.5	—	17	26	—	33	
				6.0	—	14	22	—	28	
Output enable time	t_{pZL} t_{pZH}	$R_L = 1 \text{ k}\Omega$	50	2.0	—	48	125	—	155	ns
				4.5	—	16	25	—	31	
				6.0	—	14	21	—	26	
			150	2.0	—	63	165	—	205	
				4.5	—	21	33	—	41	
				6.0	—	18	28	—	35	
Output disable time	t_{pLZ} t_{pHZ}	$R_L = 1 \text{ k}\Omega$	50	2.0	—	32	125	—	155	ns
				4.5	—	15	25	—	31	
				6.0	—	14	21	—	26	
Input capacitance	C_{IN}	—		—	5	10	—	10	pF	
Output capacitance	C_{OUT}	—		—	10	—	—	—	pF	
Power dissipation capacitance	C_{PD}	TC74HC240A		—	31	—	—	—	pF	
	(Note)	TC74HC241A/244A		—	33	—	—	—		

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

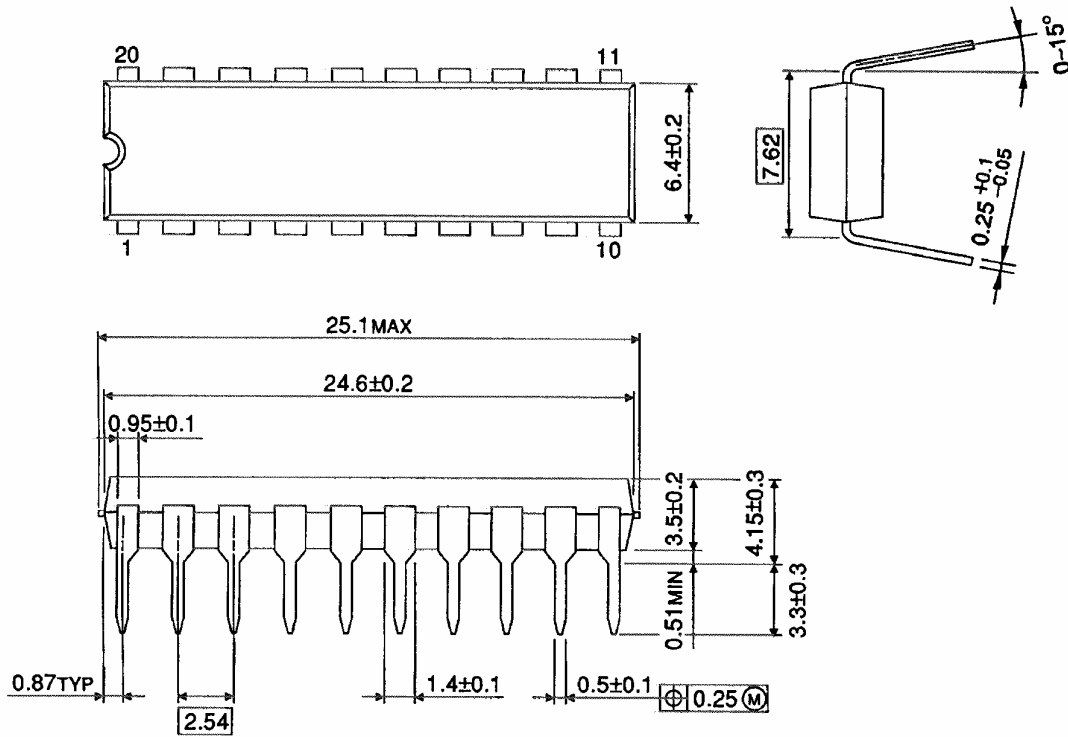
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

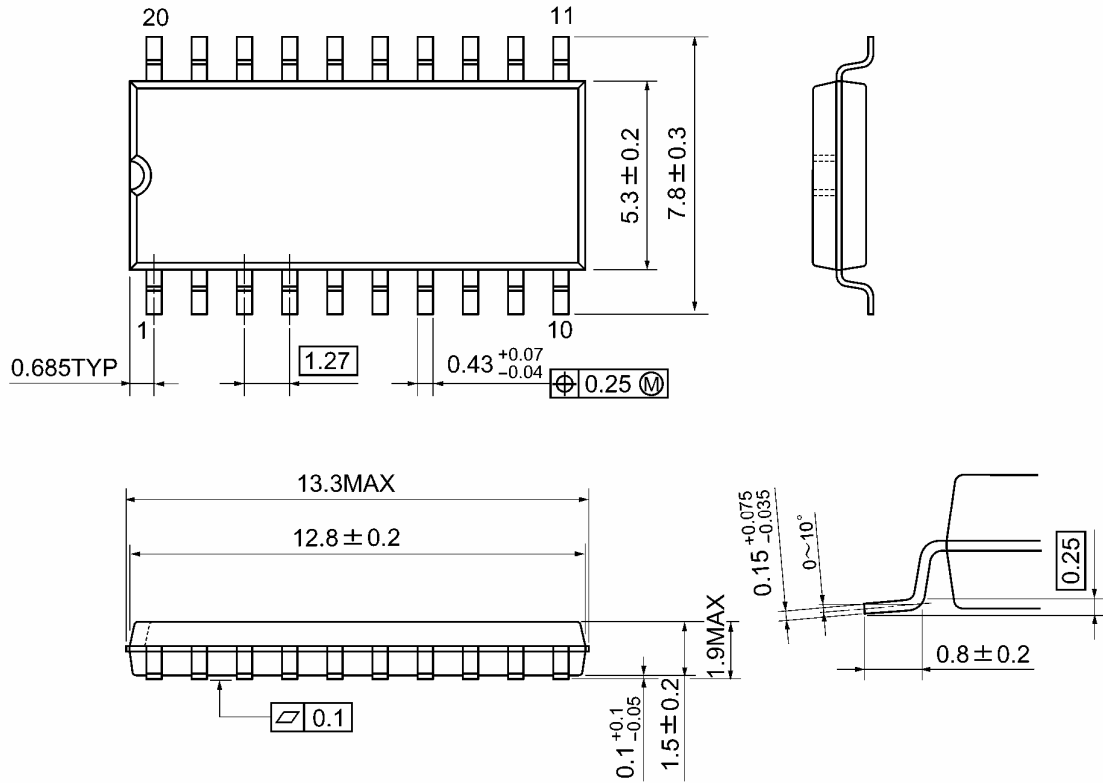


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

RESTRICTIONS ON PRODUCT USE

20070701-EN GENERAL

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc.
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patents or other rights of TOSHIBA or the third parties.
- Please contact your sales representative for product-by-product details in this document regarding RoHS compatibility. Please use these products in this document in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances. Toshiba assumes no liability for damage or losses occurring as a result of noncompliance with applicable laws and regulations.