CMOS Digital Integrated Circuits Silicon Monolithic

74HC240D,74HC244D

1. Functional Description

・ Octal Bus Buffer

74HC240D: INVERTED, 3-STATE OUTPUTS
74HC244D: NON-INVERTED, 3-STATE OUTPUTS

2. General

The 74HC240D and 74HC244D are high speed CMOS OCTAL BUS BUFFERs fabricated with silicon gate C^2MOS technology.

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

The 74HC240D is an inverting 3-state buffer and the 74HC244D are non-inverting 3-state buffers having two active-low output enables.

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

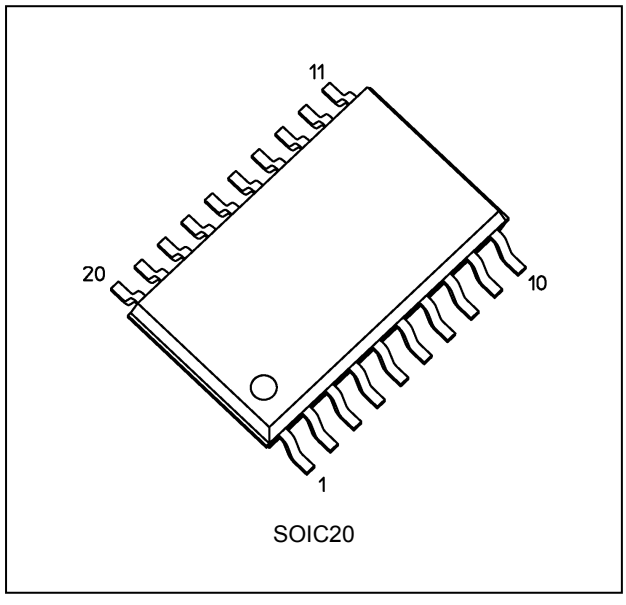
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

3. Features

(1) Wide operating temperature range: T_{opr} = -40 to 125 °C (Note 1)
(2) High speed: t_{pd} = 10 ns (typ.) at V_{CC} = 6.0 V
(3) Low power dissipation: I_{CC} = 4.0 μA (max) at T_a = 25 °C
(4) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
(5) Wide operating voltage range: $V_{CC(opr)}$ = 2.0 V to 6.0 V

Note1 1:Operating Range spec of T_{opr} = -40 °C to 125 °C is applicable only for the products which manufactured after July 2020.

4. Packaging

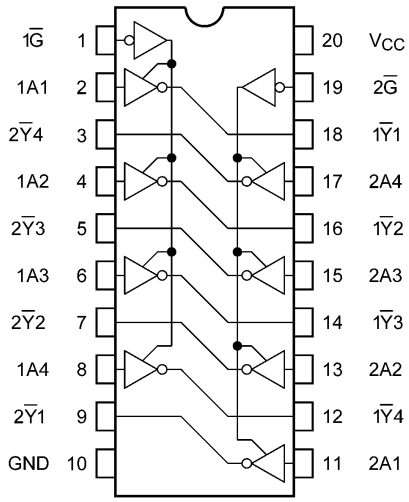


SOIC20

Start of commercial production
2020-07

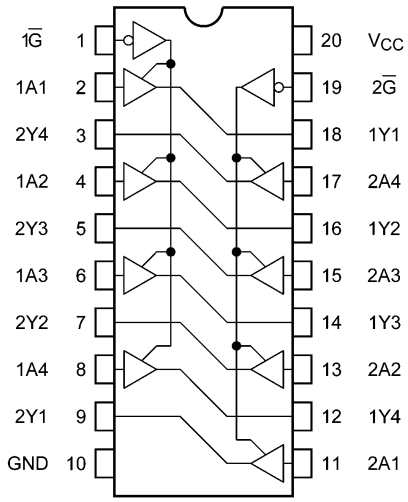
5. Pin Assignment

74HC240D



(top view)

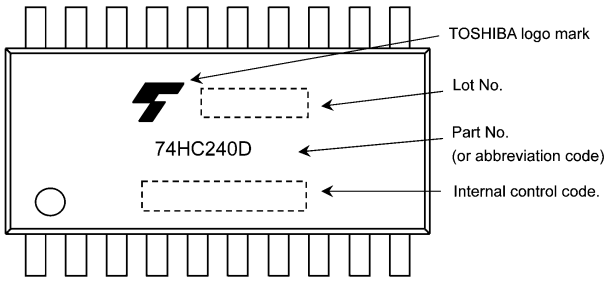
74HC244D



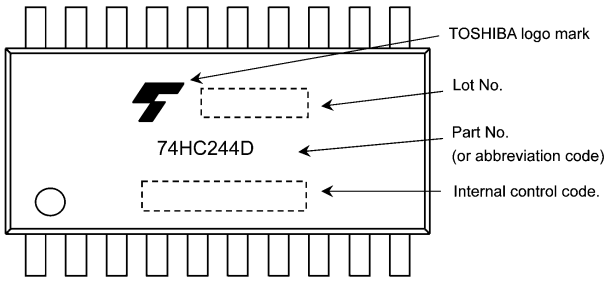
(top view)

6. Marking

74HC240D

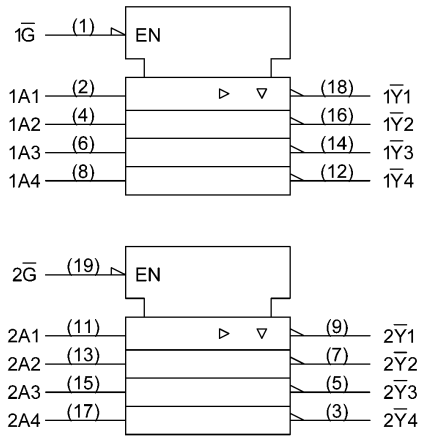


74HC244D

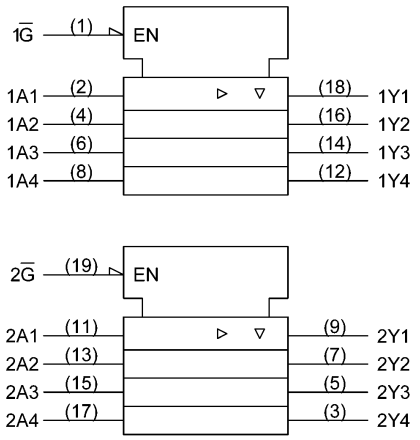


7. IEC Logic Symbol

74HC240D



74HC244D



8. Truth Table

Input $\overline{G}$	Input An	Output Yn	Output $\overline{Y}n$
L	L	L	H
L	H	H	L
H	X	Z	Z

X: Don't care
Z: High impedance
Yn: 74HC244D
$\overline{Y}n$: 74HC240D

9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CC}		-0.5 to 7.0	V
Input voltage	V_{IN}		-0.5 to V_{CC} + 0.5	V
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
Output current	I_{OUT}		±35	mA
V_{CC}/ground current	I_{CC}		±75	mA
Power dissipation	P_D	(Note 1)	500	mW
Storage temperature	T_{stg}		-65 to 150	°C

Note: 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 1: P_D derates linearly with -8 mW/°C above 85 °C

10. Operating Ranges (Note)

Characteristics	Symbol	Test Condition	Note	Rating	Unit
Supply voltage	V_{CC}			2.0 to 6.0	V
Input voltage	V_{IN}			0 to V_{CC}	V
Output voltage	V_{OUT}			0 to V_{CC}	V
Operating temperature	T_{opr}		(Note 1)	-40 to 125	°C
Input rise and fall times	t_r,t_f	V_{CC} = 2.0 V		0 to 1000	ns
		V_{CC} = 4.5 V		0 to 500	
		V_{CC} = 6.0 V		0 to 400	

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.

Note 1: Operating Range spec of T_{opr} = -40 °C to 125 °C is applicable only for the products which manufactured after July 2020.

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	—	V
				4.5	3.15	—	—	
				6.0	4.20	—	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.50	V
				4.5	—	—	1.35	
				6.0	—	—	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	—	V
				4.5	4.4	4.5	—	
				6.0	5.9	6.0	—	
			I_{OH} = -6 mA	4.5	4.18	4.31	—	
			I_{OH} = -7.8 mA	6.0	5.68	5.80	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	2.0	—	0.0	0.1	V
				4.5	—	0.0	0.1	
				6.0	—	0.0	0.1	
			I_{OL} = 6 mA	4.5	—	0.17	0.26	
			I_{OL} = 7.8 mA	6.0	—	0.18	0.26	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		6.0	—	—	±0.5	μA
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	—	—	±0.1	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	—	—	4.0	μA

11.2. DC Characteristics (Unless otherwise specified, T_a = -40 to 85 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	V
				4.5	3.15	—	
				6.0	4.20	—	
Low-level input voltage	V_{IL}	—		2.0	—	0.50	V
				4.5	—	1.35	
				6.0	—	1.80	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -20 μA	2.0	1.9	—	V
				4.5	4.4	—	
				6.0	5.9	—	
			I_{OH} = -6 mA	4.5	4.13	—	
			I_{OH} = -7.8 mA	6.0	5.63	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	2.0	—	0.1	V
				4.5	—	0.1	
				6.0	—	0.1	
			I_{OL} = 6 mA	4.5	—	0.33	
			I_{OL} = 7.8 mA	6.0	—	0.33	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		6.0	—	±5.0	μA
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	—	40.0	μA

11.3. DC Characteristics (Note) (Unless otherwise specified, T_a = -40 to 125 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.50	—	V
				4.5	3.15	—	
				6.0	4.20	—	
Low-level input voltage	V_{IL}	—		2.0	—	0.50	V
				4.5	—	1.35	
				6.0	—	1.80	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = -20 μA	2.0	1.9	—	V
				4.5	4.4	—	
				6.0	5.9	—	
			I_{OH} = -6 mA	4.5	3.7	—	
			I_{OH} = -7.8 mA	6.0	5.2	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	2.0	—	0.1	V
				4.5	—	0.1	
				6.0	—	0.1	
			I_{OL} = 6 mA	4.5	—	0.4	
			I_{OL} = 7.8 mA	6.0	—	0.4	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		6.0	—	±5.0	μA
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	—	80.0	μA

Note: Operating Range spec of T_{opr} = -40 °C to 125 °C is applicable only for the products which manufactured after July 2020.

11.4. AC Characteristics (Unless otherwise specified, T_a = 25 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Part Number	Symbol	Note	Test Condition	C_L (pF)	V_{CC} (V)	Min	Typ.	Max	Unit
Output transition time		t_{TLH},t_{THL}			50	2.0	—	25	60	ns
						4.5	—	7	12	
						6.0	—	6	10	
Propagation delay time		t_{PLH},t_{PHL}			50	2.0	—	36	90	ns
						4.5	—	12	18	
						6.0	—	10	15	
					150	2.0	—	51	130	
						4.5	—	17	26	
						6.0	—	14	22	
Output enable time		t_{PZL},t_{PZH}		R_L = 1 kΩ	50	2.0	—	48	125	ns
						4.5	—	16	25	
						6.0	—	14	21	
					150	2.0	—	63	165	
						4.5	—	21	33	
						6.0	—	18	28	
Output disable time		t_{PLZ},t_{PHZ}		R_L = 1 kΩ	50	2.0	—	32	125	ns
						4.5	—	15	25	
						6.0	—	14	21	
Input capacitance		C_{IN}		—			—	5	10	pF
Output capacitance		C_{OUT}		—			—	10	—	pF
Power dissipation capacitance	74HC240D	C_{PD}	(Note 1)	—			—	31	—	pF
	74HC244D						—	33	—	

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.

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

11.5. AC Characteristics (Unless otherwise specified, T_a = -40 to 85 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Test Condition	C_L (pF)	V_{CC} (V)	Min	Max	Unit
Output transition time	t_{TLH},t_{THL}	—	50	2.0	—	75	ns
				4.5	—	15	
				6.0	—	13	
Propagation delay time	t_{PLH},t_{PHL}	—	50	2.0	—	115	ns
				4.5	—	23	
				6.0	—	20	
			150	2.0	—	165	
				4.5	—	33	
				6.0	—	28	
Output enable time	t_{PZL},t_{PZH}	R_L = 1 kΩ	50	2.0	—	155	ns
				4.5	—	31	
				6.0	—	26	
			150	2.0	—	205	
				4.5	—	41	
				6.0	—	35	
Output disable time	t_{PLZ},t_{PHZ}	R_L = 1 kΩ	50	2.0	—	155	ns
				4.5	—	31	
				6.0	—	26	
Input capacitance	C_{IN}	—			—	10	pF

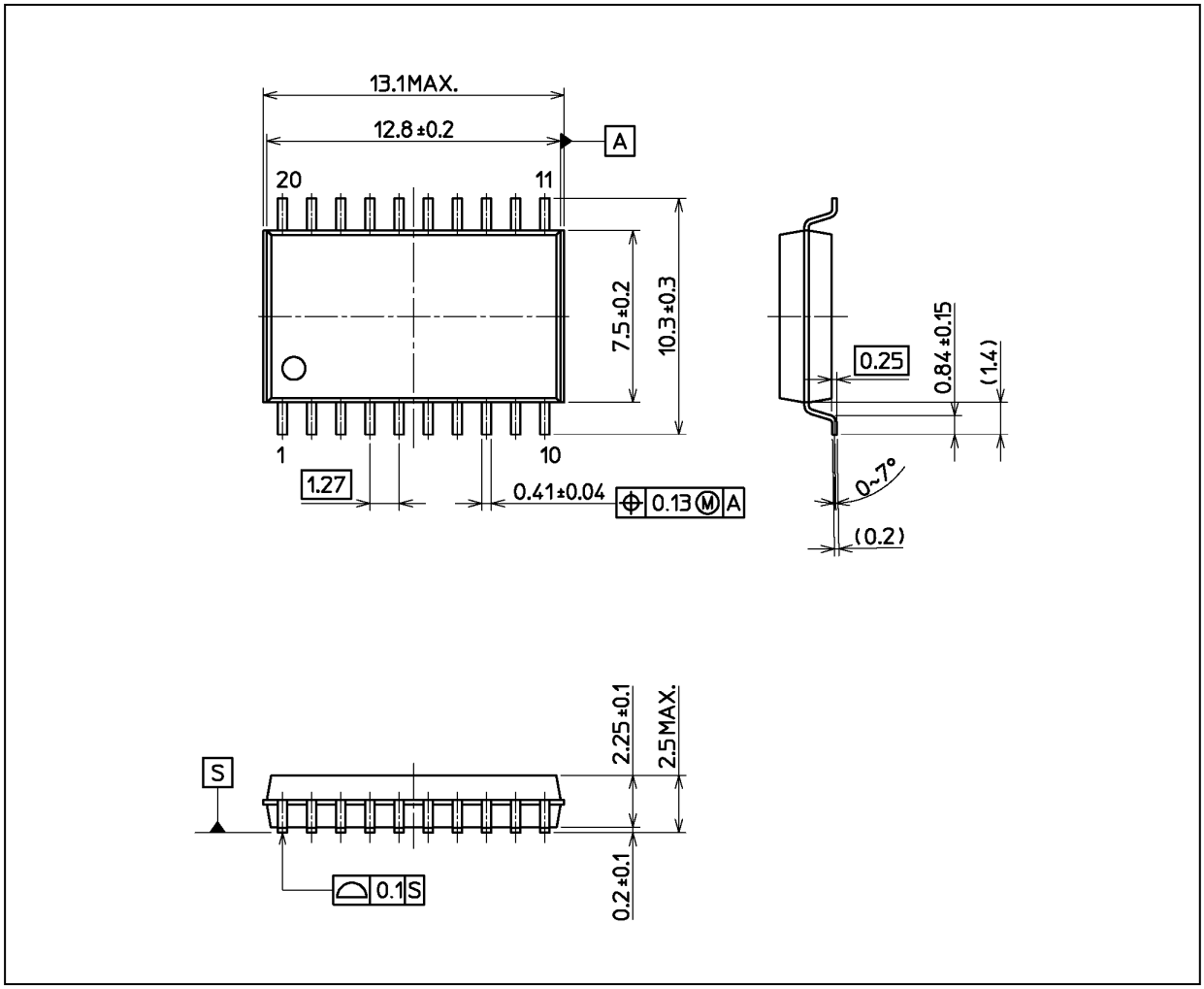
11.6. AC Characteristics (Note)
(Unless otherwise specified, T_a = -40 to 125 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Test Condition	C_L (pF)	V_{CC} (V)	Min	Max	Unit
Output transition time	t_{TLH},t_{THL}	—	50	2.0	—	85	ns
				4.5	—	17	
				6.0	—	15	
Propagation delay time	t_{PLH},t_{PHL}	—	50	2.0	—	135	ns
				4.5	—	27	
				6.0	—	24	
			150	2.0	—	190	
				4.5	—	38	
				6.0	—	32	
Output enable time	t_{PZL},t_{PZH}	R_L = 1 kΩ	50	2.0	—	175	ns
				4.5	—	35	
				6.0	—	30	
			150	2.0	—	235	
				4.5	—	47	
				6.0	—	40	
Output disable time	t_{PLZ},t_{PHZ}	R_L = 1 kΩ	50	2.0	—	175	ns
				4.5	—	35	
				6.0	—	30	
Input capacitance	C_{IN}	—			—	10	pF

Note: Operating Range spec of T_{opr} = -40 °C to 125 °C is applicable only for the products which manufactured after July 2020.

Package Dimensions

Unit: mm



Weight: 0.51 g (typ.)

Package Name(s)
Nickname: SOIC20

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