

CMOS Digital Integrated Circuits Silicon Monolithic

TC74AC240FT,TC74AC244FT

1. Functional Description

- Octal Bus Buffer
- TC74AC240FT: INVERTED, 3-STATE OUTPUTS
 TC74AC244FT: NON-INVERTED, 3-STATE OUTPUTS

2. General

The TC74AC240FT and TC74AC244FT are advanced high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate and double-layer metal wiring C²MOS technology.

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

The TC74AC240FT is an inverting 3-state buffer while the TC74AC244FT is non-inverting. Both devices have two active-low output enables.

These devices are designed to be used in such applications as 3-state memory address drivers.

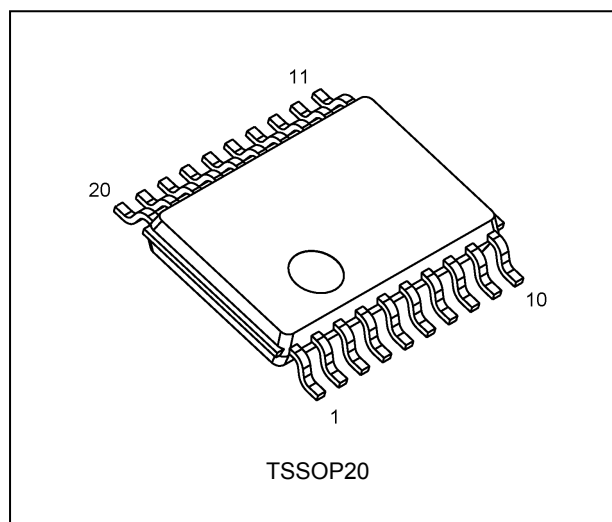
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

3. Features

- (1) Wide operating temperature range: $T_{opr} = -40$ to 125 °C (Note 1)
- (2) High speed: $t_{pd} = 4.0$ ns (typ.) at $V_{CC} = 5.0$ V
- (3) Low power dissipation: $I_{CC} = 8.0$ μ A (max) at $T_a = 25$ °C
- (4) High noise immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC} (min)
- (5) Output current: $|I_{OH}|/I_{OL} = 24$ mA (min) ($V_{CC} = 4.5$ V)
- (6) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (7) Wide operating voltage range: $V_{CC(opr)} = 2.0$ V to 5.5 V
- (8) Pin and function compatible with 74F240/244

Note 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

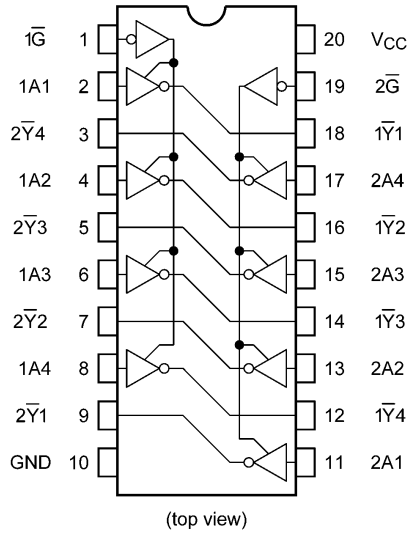


Start of commercial production

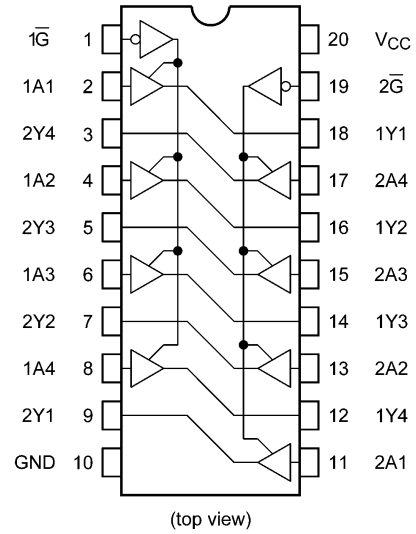
2020-07

5. Pin Assignment

TC74AC240FT

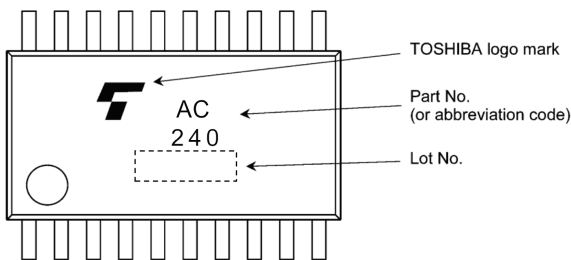


TC74AC244FT

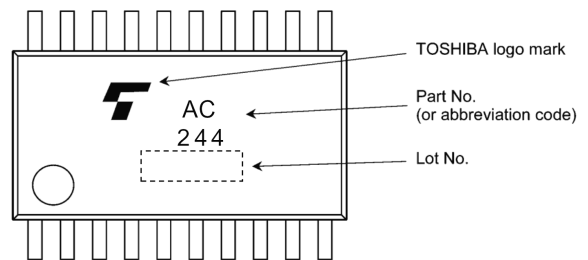


6. Marking

TC74AC240FT

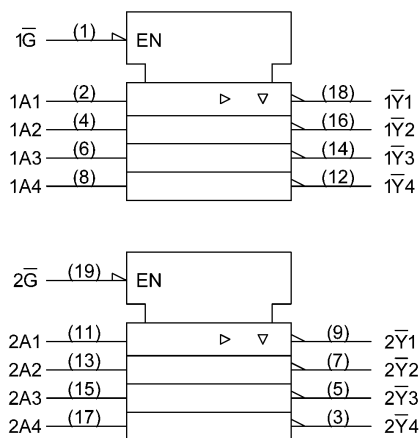


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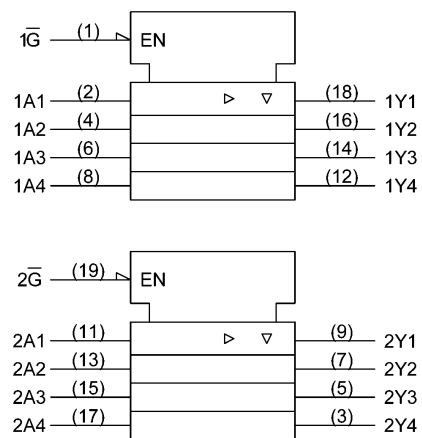


7. IEC Logic Symbol

TC74AC240FT



TC74AC244FT



8. Truth Table

Input \bar{G}	Input A_n	Output Y_n	Output \bar{Y}_n
L	L	L	H
L	H	H	L
H	X	Z	Z

X: Don't care

Z: High impedance

Y_n : TC74AC244FT

\bar{Y}_n : TC74AC240FT

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}		± 50	mA
Output current	I_{OUT}		± 50	mA
V_{CC} /ground current	I_{CC}		± 200	mA
Power dissipation	P_D	(Note 1)	180	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: 180 mW in the range of $T_a = -40$ to 85 °C. From $T_a = 85$ to 125 °C a derating factor of -3.25 mW/°C shall be applied until 50 mW.

10. Operating Ranges (Note)

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Supply voltage	V_{CC}			2.0 to 5.5	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	dt/dv		$V_{CC} = 3.3 \pm 0.3$ V	0 to 100	ns/V
			$V_{CC} = 5.0 \pm 0.5$ V	0 to 20	

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, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit	
High-level input voltage	V_{IH}	—	2.0	1.50	—	—	V	
			3.0	2.10	—	—		
			5.5	3.85	—	—		
Low-level input voltage	V_{IL}	—	2.0	—	—	0.50	V	
			3.0	—	—	0.90		
			5.5	—	—	1.65		
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50\text{ }\mu\text{A}$	2.0	1.9	2.0	—	V
				3.0	2.9	3.0	—	
				4.5	4.4	4.5	—	
			$I_{OH} = -4\text{ mA}$	3.0	2.58	—	—	
			$I_{OH} = -24\text{ mA}$	4.5	3.94	—	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50\text{ }\mu\text{A}$	2.0	—	0.0	0.1	V
				3.0	—	0.0	0.1	
				4.5	—	0.0	0.1	
			$I_{OL} = 12\text{ mA}$	3.0	—	—	0.36	
			$I_{OL} = 24\text{ mA}$	4.5	—	—	0.36	
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND	5.5	—	—	± 0.5	μA	
Input leakage current	I_{IN}	$V_{IN} = V_{CC}$ or GND	5.5	—	—	± 0.1	μA	
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	5.5	—	—	8.0	μA	

11.2. DC Characteristics (Unless otherwise specified, $T_a = -40$ to $85\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	Note	V_{CC} (V)	Min	Max	Unit		
High-level input voltage	V_{IH}	—		2.0	1.50	—	V		
				3.0	2.10	—			
				5.5	3.85	—			
Low-level input voltage	V_{IL}	—		2.0	—	0.50	V		
				3.0	—	0.90			
				5.5	—	1.65			
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50\text{ }\mu\text{A}$		2.0	1.9	—	V	
					3.0	2.9	—		
					4.5	4.4	—		
					$I_{OH} = -4\text{ mA}$	3.0	2.48		—
					$I_{OH} = -24\text{ mA}$	4.5	3.80		—
			$I_{OH} = -75\text{ mA}$ (Note 1)	5.5	3.85	—			
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50\text{ }\mu\text{A}$		2.0	—	0.1	V	
					3.0	—	0.1		
					4.5	—	0.1		
					$I_{OL} = 12\text{ mA}$	3.0	—		0.44
					$I_{OL} = 24\text{ mA}$	4.5	—		0.44
			$I_{OL} = 75\text{ mA}$ (Note 1)	5.5	—	1.65			
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND		5.5	—	± 5.0	μA		
Input leakage current	I_{IN}	$V_{IN} = V_{CC}$ or GND		5.5	—	± 1.0	μA		
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND		5.5	—	80.0	μA		

Note 1: This spec indicates the capability of driving $50\text{ }\Omega$ transmission lines.
One output should be tested within a 10 ms maximum duration.

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

Characteristics	Symbol	Test Condition		Note	V_{CC} (V)	Min	Max	Unit																						
High-level input voltage	V_{IH}	—			2.0	1.50	—	V																						
					3.0	2.10	—																							
					5.5	3.85	—																							
Low-level input voltage	V_{IL}	—			2.0	—	0.50	V																						
					3.0	—	0.90																							
					5.5	—	1.65																							
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50$ μ A		2.0	1.9	—	V																						
					3.0	2.9	—																							
					4.5	4.4	—																							
					$I_{OH} = -4$ mA	3.0	2.48		—																					
					$I_{OH} = -24$ mA	4.5	3.70		—																					
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50$ μ A		2.0	—	0.1	V																						
					3.0	—	0.1																							
					4.5	—	0.1																							
					$I_{OL} = 12$ mA	3.0	—		0.44																					
					$I_{OL} = 24$ mA	4.5	—		0.50																					
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND			5.5	—	± 10.0	μ A																						
					Input leakage current	I_{IN}	$V_{IN} = V_{CC}$ or GND			5.5	—	± 1.0	μ A																	
														Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND		5.5	—	160.0	μ A									
																						High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50$ μ A		2.0	1.9	—	V
																											3.0	2.9	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50$ μ A		2.0	—	0.1	V																						
					3.0	—	0.1																							
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND			5.5	—	± 10.0	μ A																						
					Input leakage current	I_{IN}	$V_{IN} = V_{CC}$ or GND			5.5	—	± 1.0	μ A																	
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND		5.5				—						160.0	μ A															

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

Note 1: This spec indicates the capability of driving 50 Ω transmission lines.
One output should be tested within a 10 ms maximum duration.

11.4. AC Characteristics (Unless otherwise specified, $T_a = 25$ °C, Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}	(Note 2)	$C_L = 50$ pF $R_L = 500$ Ω	3.3 \pm 0.3	—	6.3	10.5	ns
				5.0 \pm 0.5	—	4.8	7.0	
Propagation delay time	t_{PLH}, t_{PHL}	(Note 3)	$C_L = 50$ pF $R_L = 500$ Ω	3.3 \pm 0.3	—	7.0	11.4	ns
				5.0 \pm 0.5	—	5.2	7.5	
3-state output enable time	t_{PZL}, t_{PZH}		$C_L = 50$ pF $R_L = 500$ Ω	3.3 \pm 0.3	—	8.4	14.0	ns
				5.0 \pm 0.5	—	5.9	8.7	
3-state output disable time	t_{PLZ}, t_{PHZ}		$C_L = 50$ pF $R_L = 500$ Ω	3.3 \pm 0.3	—	6.4	10.5	ns
				5.0 \pm 0.5	—	5.5	7.9	
Input capacitance	C_{IN}		—	—	5	10	pF	
Output capacitance	C_{OUT}		—	—	10	—	pF	
Power dissipation capacitance	C_{PD}	(Note 1)	—	—	30	—	pF	

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.

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

Note 2: For TC74AC240FT only

Note 3: For TC74AC244FT only

11.5. AC Characteristics

(Unless otherwise specified, $T_a = -40$ to 85 °C, Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}	(Note 1)	$C_L = 50$ pF $R_L = 500$ Ω	3.3 ± 0.3	1.0	12.0	ns
				5.0 ± 0.5	1.0	8.0	
Propagation delay time	t_{PLH}, t_{PHL}	(Note 2)	$C_L = 50$ pF $R_L = 500$ Ω	3.3 ± 0.3	1.0	13.0	ns
				5.0 ± 0.5	1.0	8.5	
3-state output enable time	t_{PZL}, t_{PZH}		$C_L = 50$ pF $R_L = 500$ Ω	3.3 ± 0.3	1.0	16.0	ns
				5.0 ± 0.5	1.0	10.0	
3-state output disable time	t_{PLZ}, t_{PHZ}		$C_L = 50$ pF $R_L = 500$ Ω	3.3 ± 0.3	1.0	12.0	ns
				5.0 ± 0.5	1.0	9.0	
Input capacitance	C_{IN}		—	—	—	10	pF

Note 1: For TC74AC240FT only

Note 2: For TC74AC244FT only

11.6. AC Characteristics (Note)

(Unless otherwise specified, $T_a = -40$ to 125 °C, Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}	(Note 1)	$C_L = 50$ pF $R_L = 500$ Ω	3.3 ± 0.3	1.0	13.0	ns
				5.0 ± 0.5	1.0	8.7	
Propagation delay time	t_{PLH}, t_{PHL}	(Note 2)	$C_L = 50$ pF $R_L = 500$ Ω	3.3 ± 0.3	1.0	14.1	ns
				5.0 ± 0.5	1.0	9.2	
3-state output enable time	t_{PZL}, t_{PZH}		$C_L = 50$ pF $R_L = 500$ Ω	3.3 ± 0.3	1.0	17.4	ns
				5.0 ± 0.5	1.0	10.9	
3-state output disable time	t_{PLZ}, t_{PHZ}		$C_L = 50$ pF $R_L = 500$ Ω	3.3 ± 0.3	1.0	13.0	ns
				5.0 ± 0.5	1.0	9.8	
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.

Note 1: For TC74AC240FT only

Note 2: For TC74AC244FT only

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